Railway Mechanical Engineer

Volume 99 MAY, 1925 No. 5

Table of Contents

EDITORIALS:

Rational car inspection 257
A waste in gas cutting 257
Safety is not enough 257
The foreman's job 258
A maintenance department for motor cars 258
Attend the Fuel Association convention 258
New Books 259

WHAT OUR READERS THINK:

Further comment on floating bushings 259
The advantages of floating bushings 260
More mechanical supervision 260
Bronzing driving boxes 260

GENERAL:

Long locomotive runs on the C. B. & Q. 261
High power 2-8-4 type locomotive 267
Railway motor car service on the C. G. W. 274
Steam for enginehouse heating systems and blower lines 275

CAR DEPARTMENT:

Turtle-back roof applied to B. & A. suburban cars 277
D. L. & W. coach maintenance at Hoboken, N. J. 280
Decisions of the Arbitration Committee 283
Burlington rebuilds eight box cars a day at Aurora 284
Hand brake power for freight cars 287
Cutting large pieces on a band saw 289
Device for cutting out holes in dust guards 289

SHOP PRACTICE:

Booster inspection and maintenance 290
Portable bench for repairing air pumps 292
Tools for planing driving box shoes and wedges 293
Two-wheel truck for handling rods 293
A versatile tool for locomotive repair shops 295
Testing rack for brake cylinder packing leathers 299
Storage rack for arch brick 300
Device for drilling saddle bolt holes 301
Methods of selecting and training supervisors 301
Driving box oil grooving device 302

NEW DEVICES:

Piston designed for gasoline rail car service 303
A friction spring bolster cushion 304
A Monarch heavy production lathe 305
Betts double housing guide planer 306
The Beaudry upright air hammer 307
Portable electric circular hand saw 307
Bench lathe boring toolholder 308
Bolt-pointing and threading machine 308
Heavy duty back geared shaper 309
Multiple spindle automatic screw machine 309
Journal brass milling machine 310
A ball-bearing spur geared chain block 311
Insulation for refrigerator cars 311
Automatic shut-off valve for oil lines 312
Bearing metal adaptable to many purposes 312

GENERAL NEWS 313

NEXT MONTH

The Annual Shop Equipment Number

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY

EDWARD A. SIMMONS, *President* HENRY LEE, *Vice-President and Treasurer*
L. B. SHERMAN, *Vice-President* SAMUEL O. DUNN, *Vice-President*
CECIL R. MILLS, *Vice-President* ROY V. WRIGHT, *Secretary*
30 Church Street, New York, N. Y.
F. H. THOMPSON, *Vice-President and Business Manager, Cleveland*

Chicago: 608 South Dearborn St. Cleveland: 6007 Euclid Ave.
Washington: 17th and H Sts., N. W. New Orleans: 927 Canal St.
London: 34 Victoria Street, Westminster, S. W. 1
Cable Address: Umasigmec, London

ROY V. WRIGHT, *Editor*
C. B. PECK, *Managing Editor*
E. L. WOODWARD, *Associate Editor* L. R. GURLEY, *Associate Editor*
M. B. RICHARDSON, *Associate Editor* H. C. WILCOX, *Associate Editor*

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

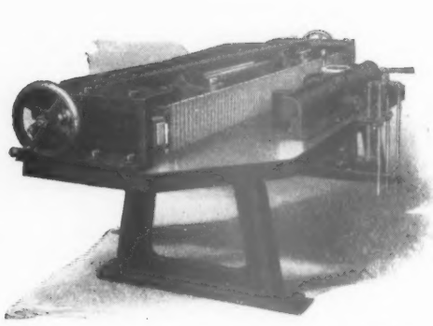
Request for change of address should reach the New York office two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, be sure to send us your old address as well as the new one.

Subscriptions, including the eight daily editions of the Railway Age published in June, in connection with the annual convention of the American Railway Association, Mechanical Division, payable in advance and postage free: United States, Canada and Mexico, $3.00 a year; foreign countries, not including daily editions of the Railway Age, $4.00. Foreign subscription may be paid through our London office, 34 Victoria Street, S. W. 1, in £ s. d. Single copy 35 cents.

The *Railway Mechanical Engineer* is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulation (A. B. C.).

Railroad Saves $21,500 Using Ryerson Spring Shop Equipment

ONE eastern railroad, by using Ryerson Standard Spring Shop Equipment, saved $21,500 in 2½ years after amortizing the cost of the entire equipment. Another road reduced its locomotive spring cost from $4.40 to $3.20 per hundred lbs.



Universal Elliptic Spring Forming Machine.

One important machine of the Ryerson Standard Spring Shop Equipment is the Universal Spring Former. Absolute fit and perfect camber is produced in a single operation. Perfectly fitted springs made with this machine increased the life of springs on one large trunk line, over 300%.

Send for the facts on this equipment. It will mean a big saving on your spring costs. Ask for Bulletin 20,203.

JOSEPH T. RYERSON & SON INC.

ESTABLISHED 1842

PLANTS: CHICAGO MILWAUKEE ST. LOUIS CINCINNATI DETROIT NEW YORK BUFFALO

BRANCH OFFICES: DENVER HOUSTON TULSA NEWARK MINNEAPOLIS SAN FRANCISCO JERSEY CITY

RYERSON MACHINERY

Railway Mechanical Engineer

Vol. 99 May, 1925 No. 5

Unquestionably the interchange inspection and terminal inspection of railway cars is of great importance. The methods of inspection are important, as are also the thoroughness and rapidity with which the work is carried on. Without adequate inspection, the safe movement of all passengers and passenger equipment, freight and freight equipment handled in train service, would be impossible. Therefore the business of inspecting cars is second to none in importance on the railroads and should attract to this service men of intelligence, keen perception and reliability, who have a full understanding of their duties and responsibilities.

Rational car inspection

The business of inspecting cars calls for the display of much judgment and good, sound common sense. How many times are cars delayed and material wasted because of too technical inspection and too much emphasis on the letter rather than the spirit of the law? Too technical inspection as opposed to rational car inspection is quite likely to be the rule after a wreck on the line has caused the inspection forces to be called to account, although the wreck is far more often caused by failure to observe defective parts rather than laxness in maintaining the rules. The demands for economical operation are fully as pressing in railroading as in any other line of business and therefore rational or reasonable inspection should at all times be the ideal toward which car inspectors strive.

Considerable credit for the development of good welding and cutting practice in this country must be given to the careful and conscientious experimental work which has been carried on in the railroad shops of this country. Practically every railroad has made it its business to try out all the various processes on practically every kind of metal and on account of the necessity for taking certain safety precautions, a large part of this experimental work has resulted in the standardization of methods and proper regulations for all the processes. There has been, however, little done towards the improvement of one phase of this work and that is the use of the torch for cutting scrap material. Undoubtedly, the largest proportion of this work is performed in cutting up scrap metal in the car repair yard and at the scrap dock, and for some reason there seems to be a tendency to give the least amount of thought and attention to the finer details of operation in this work. The cutter who is engaged in it necessarily operates under a number of disadvantages which prevent him from making the speed and maintaining the low gas cost which is possible under conditions where output is a more important factor. Perhaps the principal reason for neglecting this study of cutting scrap material is because it is scrap. There are instances where a considerable saving has been accomplished by devoting a reasonable amount of study to this particular phase of shop work. If your gas cutting costs are too high, perhaps you will find the wasted gas and wasted time in the scrap pile.

A waste in gas cutting

The periods at which the various parts of the air brake equipment require attention in order to keep them functioning properly have been very well established. Practically every railroad has instruction pamphlets, circular letters, etc., in force outlining the attention that should be given to different parts and stating the periods at which it should be given. Very little trouble is experienced where the instructions are followed closely, which indicates that this is the policy that should be followed in order to attain the desired efficiency. However, instances have occurred where the instructions were found to be at fault relative to the time assigned for periodic inspections.

Safety is not enough

It is well to keep in mind that the limits established by the Interstate Commerce Commission are limits beyond which the device is not permitted to remain in service. It is evident that there may be cases where the device will not be in good working condition for a considerable period of time before it reaches the condemning limits. For example, the Interstate Commerce Commission requirements for the capacity of an 8½-in. cross compound air compressor are that the pump must maintain 60 lb. main reservoir pressure, the air escaping from the main reservoir through an orifice 9/32-in. in diameter, and the speed of the pump not to exceed 100 strokes per minute at an altitude not to exceed 1,000 ft. This test, which is required every three months, merely determines the efficiency of the air end of the pump. The number of strokes, however, can be increased by leakage past packing rings, air valves, piston rod packing, and to some extent by carbonized ports and passages. An air compressor, other than the cross-compound, operating at its best is not economical in its use of steam as no means has been provided for utilizing the expansive force, and anything that causes an increase in the number of strokes necessary to maintain pressure is wasting fuel, even with the cross-compound air compressor.

Another example of a device that can cause considerable waste and a possible air brake failure, is the feed valve. An entire air brake equipment may be seriously affected by a feed valve which is not functioning properly. It gets out of order easier than other parts and considerably more depends upon its successful operation than, for example, a single brake cylinder.

There are too many air brake inspectors and repair men inclined to let repairs to their equipment go to the limits prescribed by law as being in a safe and suitable condition

for service. The majority of delays due to air brake defects can usually be traced directly or indirectly to the failure on the part of someone to do the thing which should have been done at the proper time. From the standpoint of economy it is essential that each part function properly in its relation to the other parts of the air brake equipment. The most successful way to prevent waste through the operation of air brake equipment is to see that the instructions require that attention be given to the various parts at periods estimated to secure efficient operation and not merely to comply with the law.

The Foreman's Job

Last fall the *Railway Mechanical Engineer* announced a competition for the best articles dealing with the opportunities and responsibilities of the foreman. The contest closed on December 1, 1924. The decision of the judges has been delayed for two reasons. In the first place the competition proved to be one of the most successful that we have ever held, judged on the basis of the number of manuscripts that were received. In addition to this, however, the grade of the material was high and some difficulty was found in classifying it and coming to a final decision as to the two prize winners. The articles as they were submitted to the judges had the names of the competitors and all identification marks removed and were designated by number. In checking up we find that the first prize of $50 goes to "Bill Brown." This is a nom de plume, the writer preferring, for various reasons, to keep his identity secret. We can say, however, that he is a superintendent of a large and one of the most successfully operated railroad shop plants in the United States. The second prize of $35 goes to John H. Linn, assistant supervisor of apprentices, Atchison, Topeka & Santa Fe, Topeka, Kans. No third prize was offered, but at the suggestion of the judges we are adding a third prize of $25 for the contribution submitted by J. W. Murphy, the general foreman of the Boston & Albany at West Springfield, Mass. Several of the other articles crowded the prize winners pretty hard and these will be published during the coming months, particularly since they present more or less widely varying viewpoints. The first prize article will be published in our June number and will be accompanied by the results of a study which we have been making as to the practices of the various railroads in coaching and training the foremen to develop their leadership ability. A study of the articles which were received in the competition indicates that a very widespread and deep-seated interest is being shown in this question.

A maintenance department for motor cars

The utilization of the rail motor car for handling traffic on lines where business is light has already passed the experimental stage on a number of railroads. The Chicago Great Western has been among the leaders in adopting the motor car for this type of service and the mechanical department of this road has made special efforts towards solving the problem of maintenance on this particular type of equipment. The reader can gain considerable information relative to motor car maintenance from the abstract of a paper published on another page of this issue, by E. J. Brennan, superintendent of motive power, Chicago Great Western, Oelwein, Iowa, which was read before the Minneapolis section of the Society of Automotive Engineers. The Chicago Great Western has found it necessary to develop a gas engine department for the care of its motor cars and this department is in a great degree responsible for their successful performance. The gas car organization includes a motor car expert who is on the immediate staff of the superintendent of motive power and his jurisdiction extends over the entire system. It is his business to see that the cars are properly maintained and that the enginemen who want to qualify as motor car operators are properly instructed. The main shop at Oelwein has a gas engine repair organization for performing heavy and medium repairs, consisting of a foreman and several mechanics, helpers and apprentices who are engaged in gas engine work entirely. Light repairs on cars laying over at the engine terminal are performed by a specially trained gas engine mechanic. The Chicago Great Western is now considering the building of a separate repair shop somewhat removed from the main locomotive repair shops, owing to the fire hazard existing in motor car maintenance.

It is well to bear in mind that as new equipment of this type is purchased it must be maintained. The principal reason for buying motor equipment is to reduce operating expense and it is the job of the mechanical department to see that the expense of maintenance is kept at a minimum. This can be done if the responsible mechanical department officers make it their business to see that proper steps are taken towards placing the work of maintenance on the right basis at the beginning so that it can be developed as the number of motor cars increase. It is harder to reorganize a system which has been allowed to develop in a haphazard manner than to see that the work is properly organized at the start.

Attend the Fuel Association convention

The first of the important railroad mechanical meetings with which the convention season will open this year is that of the International Railway Fuel Association, to be held in Chicago, May 26-29. The program for this convention, which is published elsewhere in this issue, marks a unique undertaking in respect to the scope of topics to be considered and in an arrangement of subjects that serves to emphasize the relation of operating, mechanical and purchasing departments to fuel conservation. Of these departments, the mechanical is most closely identified with fuel use and can probably make the greatest contribution toward fuel conservation. The magnitude of railway fuel expenditures and opportunities for economy in fuel use are so large on all railroads that every mechanical officer should take an interest in the activities of an association devoted to railway fuel conservation.

Many mechanical officers other than those directly affiliated with fuel organizations will benefit by attending this convention. In this class there is no one man, other than the chief mechanical officer, who can individually control fuel use to a greater extent than the mechanical engineer through attention to details in design, and insistence upon standards that are essential to economy. If tests are conducted under the jurisdiction of the mechanical engineer this affords a further opportunity for promoting fuel efficiency by analytical study and judicious selection of efficient equipment. It will be noted that the convention program referred to includes a number of individual papers and reports by mechanical and test engineers on subjects relating to equipment that affects fuel use.

The first report on Diesel locomotives to be presented before a technical association in this country will be included in the proceedings of the Fuel Association together with a discussion of this development from an operating and fuel standpoint.

Incidentally, it will be observed that the practice in

regard to fully scheduling subjects and discussions followed by some of the leading technical societies will be adopted for the first time by a railway association and it is hoped that this innovation will prove successful as there is no doubt but that the proceedings at a majority of conventions could be made to cover a wider field more effectively by strict adherence to a systematic division of time between the topics to be considered.

Other classes of mechanical department employees, besides those included in the fuel organization, who would benefit particularly by attending this convention, are the roundhouse foremen, road foremen and master mechanics. It is understood that one railroad will make an especial effort to have as many roundhouse foremen as possible attend this convention knowing that these men are in a position to effect large fuel savings by the attention given to maintaining motive power and the manner in which this equipment is handled at the terminals. The International Railway Fuel Association was the first to inaugurate a committee on locomotive feed water heaters and subsequent reports of this committee have shown to what extent the efficiency of this device is influenced by the maintenance attention it receives at terminals. This is one of the subjects to be considered at the approaching convention and in addition to this, the committee will have information of interest to roundhouse foremen on the fuel cost of firing up locomotives at terminals and methods employed.

To the man in the fuel department who is identified with a mechanical organization, the work of this Association is indispensable and the program for this year's convention contains an unusual number of items of vital educational value. To the man in the operating department, the paper "How Can Railroad Management Affect Fuel Economy?" by A. R. Ayers, assistant general manager of the Nickel Plate, will perhaps be of most interest. Purchasing and stores officers responsible for placing orders for railway fuel will doubtless find much food for constructive thought in the paper by H. C. Pearce, director of purchases and stores of the Chesapeake & Ohio, "How Can Fuel Purchases Effect Economy?" The way in which mechanical officers can influence fuel economy will be discussed by John Purcell, assistant to the vice-president of the Atchison, Topeka & Santa Fe.

Turn to the International Railway Fuel Association convention program presented elsewhere in this issue and study it carefully. You will probably decide that in the interests of your road and your own mental improvement, you cannot afford *not* to attend this carefully planned, constructive and instructive convention. The opportunity to study at first hand the many fuel saving devices and equipment to be shown at the accompanying exhibition will alone be worth the cost of the trip to Chicago.

New Books

TECHNICAL MECHANICS, STATICS, KINEMATICS, AND KINETICS. *By Edward R. Maurer, Professor of Mechanics, and Raymond J. Roark, Assistant Professor of Mechanics, University of Wisconsin. 364 Pages, 6 in. by 9¼ in., with Illustrations and Diagrams. Price $3.50 Net. Published by John Wiley & Sons, Inc., New York.*

Written primarily as a text book for engineering students, the authors have succeeded in handling what is generally conceded to be a subject requiring close application on the part of the reader in an interesting manner. Considerable pains have been taken in distinguishing the difference between theoretical and applied mechanics. The former is divided into statics, which treats of the relations between forces that act on bodies at rest; kinematics, which treats of motion, or the manner in which things move without regard to the cause of their motion; and kinetics, which treats of the effect of forces in producing or modifying motion. The explanations of the various factors entering into the body of exact laws and principles, comprising theoretical mechanics, that have been mathematically deduced from certain fundamental facts are unusually clear and are well illustrated with numerous diagrams, based largely on practical applications. The utilization of the various laws and principles of theoretical mechanics in the solving of practical problems in applied mechanics, is explained by problem or illustration in each case. The problems and illustrations have evidently been selected from such as should already be known to the student through past experience, though probably in a more general and qualitative, rather than in a precise and formal way.

The book is divided into 14 chapters, with two appendices and a section devoted to problems. The first seven chapters are devoted to the general subject of statics, which discusses the subjects of forces and force systems, composition and reduction of forces, forces in equilibrium, simple structures, friction, center of gravity; centroids, and suspended cables. The subject of kinematics is divided into two chapters on the motion of a point and the motion of a rigid body. The last chapter in the section includes a discussion of relative motion. Chapters 10 to 14 inclusive are placed under the general head of kinetics, and are divided under the following sub-heads, i.e.; fundamental facts; kinetics of a particle, kinetics of a body, work, power, energy, momentum and impulse, and the dimensional motion of a rigid body. Appendix A is a discussion of the theory of dimension of units and Appendix B is on the moment of inertia of wheels.

What Our Readers Think

Further comment on floating bushings

PERU, Ind.

TO THE EDITOR:

In your April issue appeared a letter from S. J. Stark, general roundhouse foreman, International-Great Northern, San Antonio, Tex., regarding the advantages of the floating bushing. The Federal inspection of locomotives at the present time is quite exacting and is becoming more so each year, and there are times when it is a struggle to get power when it is badly needed. The brasses in solid rods are held in position by a press fit and keeper bolts. This has been the practice for about 40 years, about the length of time that solid rods became universal in the United States.

With the modern Mikado type locomotive, it takes about 24 man-hours to apply a set of rod bushings. The brass alone, not counting the labor for machine work, costs about $150. If the keeper bolts are lost, the bushing will move in the rod and this usually results in a damaged pin or a cut bushing, because the lubrication is cut off from the pin. If the rod moves as much as ¼ in. on the brass, it constitutes a Federal defect and I might mention that no keeper bolt ever held a bushing in place if the bushing was loose in the rod.

We have a bearing on the Wabash that can be applied to a set of rods on a Mikado type locomotive in two hours without removing the rods from the pins. The cost of the

brass in this bearing does not exceed $50, and it is impossible to get a Federal defect from side play. The lubrication is positive at all times as provisions have been made for a reserve supply of grease in the rod. Recently a bearing was changed on one of our Pacific type locomotives in seven minutes. I know that many old shopmen will say that this is impossible, but it was done, nevertheless. This type of floating bushing has been applied to a number of Wabash locomotives and they are giving excellent results.

J. E. Allen.

The advantages of floating bushings

Brownwood, Tex.

To the Editor:

I read the letter from S. J. Stark in your April issue asking what advantages have floating bushings. I am of the opinion that the floating bushing was designed to reduce the cost of labor, reinforce the rods, eliminate the old strap and to reduce engine failures. It is claimed that 75 per cent of the engine failures are due to rod defects. Taking this into account, we also find that there is another item to consider and that is the fact that main crank pins will wear out of round as the bushing becomes worn. It is evident that all enginehouses ought to be equipped with devices for turning crank pins.

If we figure the extra cost, I don't think a very large percentage has been gained. I do not wish to condemn the floating bushing idea, but I merely am stating the facts resulting from my experience along this line of work.

I would also like to suggest to the mechanical engineers that some device should be designed to overcome this defect on pins, such as using a sliding flanged brass, split in half with heavy wedge blocks. It seems to me that such an arrangement is worth consideration.

B. G. Miller.

More mechanical supervision

Chicago.

To the Editor:

The mechanical department on our road has to a considerable extent organized along the lines suggested in the editorial, "More specialized men needed," published in the February *Railway Mechanical Engineer*, page 74. The executives in charge of many railroads, who have had ample time to analyze carefully maintenance of equipment problems, will recognize the value of a thoroughly specialized organization composed of men particularly selected on account of their experience, training and ability to handle a definite section of the organization which keeps railroad equipment in condition to give efficient service.

Officers in charge of railroad mechanical departments, so far as I have been able to learn, are seldom overpaid and in many instances their salaries are much lower than those accorded men holding equal or less responsible positions in other industries. The one hopeful feature for the mechanical officer, I would say, is the fact that railroad executives are of late years recognizing to a greater extent than ever before the possibilities for better and more economical service. They are providing more adequate facilities and equipment, even though progress along this line appears to be slow. Some intangible thing about railroad work is extremely fascinating, and this undoubtedly answers the question why railroad companies are able to hold competent men as they do when attractive offers come from other industries.

The difficulty in retaining the right caliber of men will doubtless force a change in the general aspect of the situation as experienced in the past, and it may be that the modification in viewpoint mentioned will carry with it a demand for a different type of mechanical officer and remuneration commensurate with the ability to obtain greater real results.

Superintendent of Motive Power.

Bronzing driving boxes

A question

Topeka, Kansas.

To the Editor:

In this shop we occasionally have difficulty in getting the brass liners on the shoe and wedge faces of driving boxes to lay down tight against the box. They are cast on, the box receiving two crosswise dovetail slots on the planer before it is sent to the brass foundry. In the foundry the box is not heated nor tinned but the brass is poured on the box cold. I think tinning should be considered only as a last resort as it would be quite expensive to tin all the boxes before casting on the liners. We find the brass lays down a little better on a new box than it does on an old, greasy one. Possibly the experience of some of your readers would be of assistance to me in the solution of this problem.

A Foreman.

The answer

Portsmouth, Ohio.

To the Editor:

In reply to an inquiry from one of your readers relating to bronzing the shoe and wedge faces of the driving boxes, if he will dovetail the driving boxes as described in an article on driving box work by the writer, which appeared in the September, 1924, *Railway Mechanical Engineer*, instead of crossing the dovetail grooves he will not only get better results but will be able to do the job much more quickly. Less than two per cent of our brass liners work loose on driving boxes.

In doing this work, the old bronze is stripped off the driving boxes and the grooves and anchor holes are cleaned of all pieces of the old bronze. The boxes are then sent to the bronze shop, where they are heated with a special torch using kerosene or crude oil, heating both sides of the boxes at one operation. This burner or heater is made of one 2-in. pipe drilled with 1/32-in. holes 4 in. apart, much the same as a tire heater would be made except that it is made to fit the boxes. It is not necessary to get the boxes very hot. After they are heated, the bronzing jig shown in the above mentioned article is placed on the box and the bronze poured on one side and then the other side. The jig is then removed and the box allowed to cool gradually.

We find that it is not good practice to put this bronze on too thin. Not less than ½ in. of bronze should be applied to a box, ⅛ in. of this for finishing, leaving about ⅜ in. of bronze after the boxes are machined. Several anchor holes should be drilled in each side of the box in addition to the dovetail grooves. You will note that the sketch referred to shows two dovetail grooves tapering together at the top; that is, the grooves are much closer at the top of the boxes than at the bottom. This also has a tendency to keep the liners tight should they show any signs of getting loose.

If these instructions are followed, I am sure there will be an improvement in the application of the bronze liners to the shoe and wedge faces of driving boxes.

J. H. Hahn,
Machine shop foreman, Norfolk & Western.

Long locomotive runs on the C. B. & Q.

Greatest economies are made in fuel and enginehouse expense—Savings exceed nine thousand dollars per month

PASSENGER locomotives of the Chicago, Burlington & Quincy were run through from Chicago to Burlington, Iowa, as early as 1911. However, the first regular long engine run on this road was put into effect in freight service between Alliance and Ravenna, Neb., in December, 1920; a passenger run between Wymore and McCook, Neb., was inaugurated in March, 1922; and in May, 1923, the first Burlington locomotive hauled train No. 2 from Denver, Colo., past three intermediate terminals to Lincoln, Neb., a distance of 485 miles and one of the longer coal-burning locomotive runs now regularly made.

In the past two years long engine runs have been extended quite generally over the Burlington System, giving the road an extensive experience which, under varying conditions, has demonstrated the value of this method of securing greater and more economical service from its motive power. On the system as a whole, the monthly and yearly savings and the number of locomotives released for other service are as follows:

System savings, freight and passenger service, due to long runs

	Monthly saving	Yearly saving	Engine released for other service
Lines East	$5,889	$70,668	17
Lines West	3,537	42,444	13
Total	$9,426	$113,112	30

These savings have been made possible by the co-operation of all departments, and also to some extent, from a mechanical point of view, by the substitution of Hulson grates for the common finger grates formerly used. With certain of the bituminous mine-run coals burned on the Burlington, 200 miles has been about the practical limit which a locomotive equipped with finger grates could run, owing to the accumulation of excessive quantities of clinker and ash. Tests have shown that with the new grates and the exercise of reasonable care on the part of firemen, these conditions are prevented and fires can be kept well beyond the mileage limit established by other considerations.

Experience on the Burlington indicates that the extension of locomotive runs over two or more divisions has practically no bearing on the cost of repairs per mile, but that real economies are to be found in the more intensive use of locomotives, the saving of enginehouse expense at intermediate terminals and in fuel economy. Moreover, the release of certain engines has permitted a reassignment of motive power to runs where it can give a more efficient performance. For example, quite a number of engines designed primarily for freight service were used on passenger trains until the inauguration of the long runs enabled them to be released.

All of the long engine runs, both passenger and freight, now being made on the Burlington are shown in Tables I and III, the savings being given in Tables II and IV. The locations of the various terminals are indicated in the map which also shows how generally the long runs are distributed over the entire Burlington system.

There are six trains (Nos. 47, 48, 49, 50, 51 and 52) between Chicago and St. Paul, Minn., making a total of 2,586 miles a day. Formerly these trains were handled by nine locomotives which number has now been reduced to seven. This has saved two locomotives and increased the average miles per day for these locomotives from 276 to 369, or 93 miles.

Between Burlington, Iowa, and Lincoln, Neb., there are six trains (Nos. 2, 3, 5, 6, 9 and 12) making a daily mileage of 2,070. Formerly handled with thirteen locomotives, these trains are now handled with nine locomotives, releasing four for other service. The average daily mileage per locomotive has increased 71.

On the Nebraska district 10 trains (Nos. 3, 5, 9, 15, 17, 2, 6, 14 and 16) make a daily mileage of 4,189. Prior to extended runs, 25 locomotives were used in this service, making the average daily mileage per locomotive 167. Under the new system 18 locomotives are being used, increasing the average daily mileage per locomotive to 233, or an increase of 66. These are but a few selected long runs. On the road as a whole the inauguration of long engine runs has increased the average daily mileage of the passenger locomotives involved, by 72 miles, as shown in Table V, resulting in the release of 23 locomotives for other service. The total daily train mileage made is 14,607.

Reference to Tables I and III will indicate the preponderance of passenger over freight locomotive runs. Long runs are being inaugurated in freight service, however, as fast as practicable.

In connection with the Lincoln-Denver runs it will be noted that eastbound there is no engine change but, owing to adverse grades westbound and the consequent heavy working of the locomotives, considerable more attention is required at McCook, Neb., than could be given without undue delay to the trains. As a result, train Nos. 3 and 9 change locomotives at McCook.

More or less the same conditions exist with regard to the Denver, Colo., to Billings, Mont., runs. All locomotives are changed at Casper, Wyo. Northbound they also change at Greybull, but southbound they run through from Billings to Casper.

Formerly the Colorado & Southern used one engine between Denver and Cheyenne on trains 29 and 30—one engine between Cheyenne and Casper on the same trains

Principal dimensions of Burlington engines used in long runs

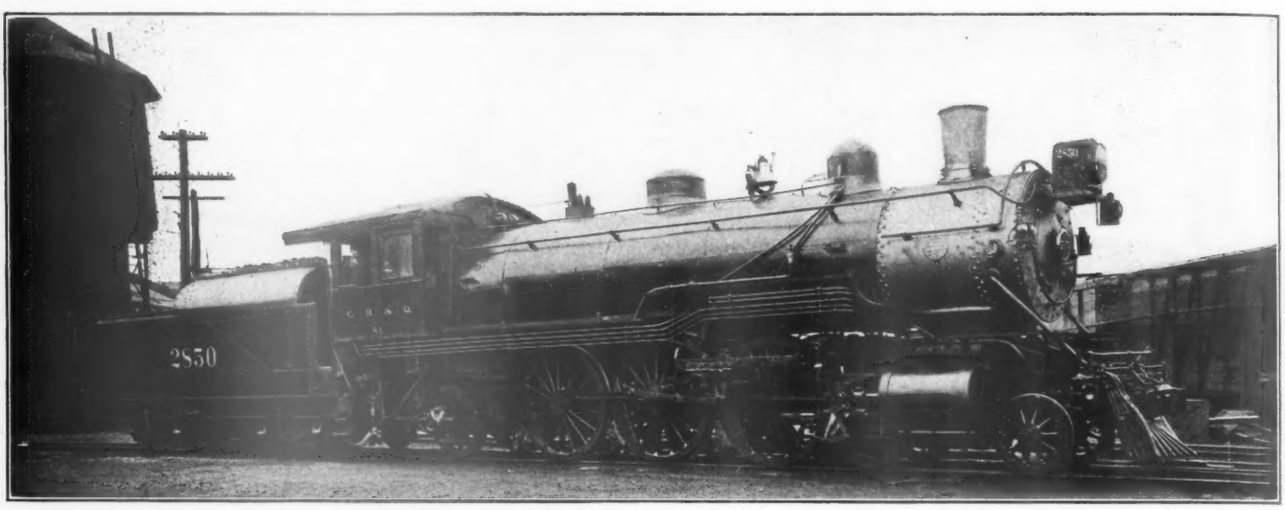
	0-1-A	S-1	S-2	S-3	B-1
Wheel arrangement	2 8-2	4-6-2	4-6-2	4-6-2	4-8-2
Tractive force	52,300 lb.	37,200 lb.	37,200 lb.	42,200 lb.	52,750 lb.
Grate area	58.8 sq. ft.	54.2 sq. ft.	54.2 sq. ft.	58.7 sq. ft.	78.0 sq. ft.
Total square feet heating surface	4,145 sq. ft.	3,699 sq. ft.	3,680 sq. ft.	4,115 sq. ft.	5,629.7 sq. ft.
Weight on drivers	214,550 lb.	150,000 lb.	153,100 lb.	171,300 lb.	235,500 lb.
Weight of engine	272,300 lb.	228,000 lb.	236,100 lb.	269,200 lb.	350,000 lb.
Total weight engine and tender	467,300 lb.	376,200 lb.	396,400 lb.	432,740 lb.	555,450 lb.
Cylinders	27 in. by 30 in.	22 in. by 28 in. and 25 in. by 28 in.	22 in. by 28 in. and 25 in. by 28 in.	27 in. by 28 in.	27 in. by 30 in.

and the Chicago, Burlington & Quincy furnished one engine between Casper and Cheyenne, making a total of three engines between Denver and Casper. The engine runs are now between Casper and Denver. One C. B. & Q. engine is being used instead of two Colorado & Southern engines to equalize the mileage, since 240 of the 339 miles are on the Colorado & Southern.

Freight engines are run through from Casper and Greybull as business requires. A mixed class of power is in service, being used to the best advantage to fit the tonnage east and west of Bonneville.

In the freight pool between Alliance and Ravenna, Neb., twenty 0-1-A locomotives were formerly used. Since running through the terminal at Seneca without change, only eighteen locomotives are required, thus saving two 0-1-A locomotives.

From a consideration of Tables II and IV it will be evident that on both the east and west lines of the Burling-



Engine 2850 equipped with Hulson grates made 1,492 miles in 121 hours with a single fire

Table I—Long engine runs on the C. B. & Q. (Lines east)

Train Nos.	Present assignment: Present terminal Initial	Present assignment: Present terminal Final	Present assignment: Class of loco.	Present assignment: No. of miles	Former Assignment: Former Terminal Initial	Former Assignment: Former Terminal Final	Former Assignment: Class of loco.	Former Assignment: No. of miles
			(Chicago-Savanna-St. Paul.)					
49-51	Chicago	St. Paul	S-1-A	431	Chicago	Savanna	S-1-A	145
					Savanna	St. Paul	S-2-A	286
50-52	St. Paul	Chicago	S-2-A	431	St. Paul	Savanna	S-2-A	286
					Savanna	Chicago	S-1-A	145
47	Chicago	Minneapolis	S-1-A	442	Chicago	Savanna	S-1-A	145
					Savanna	Minneapolis	S-1-A	297
48	Minneapolis	Chicago	S-2-A	442	Minneapolis	Savanna	S-2	297
					Savanna	Chicago	S-1-A	145
			(St. Louis-Beardstown-Galesburg.)					
47-51	St. Louis	Galesburg	P-2	208	St. Louis	Beardstown	P-2	114
					Beardstown	Galesburg	K-2	94
48-52	Galesburg	St. Louis	P-2	208	Galesburg	Beardstown	K-10	94
					Beardstown	St. Louis	P-2	114
			(Galesburg-Brookfield-Kansas City.)					
55	Galesburg	Kansas City	S-2	327	Galesburg	Brookfield	S-2	204
					Brookfield	Kansas City		123
56	Kansas City	Galesburg	S-2	327	Kansas City	Brookfield		123
					Brookfield	Galesburg	S-2	204
			(Burlington-Creston-Lincoln.)					
3-5-9	Burlington	Lincoln	S-3	345	Burlington	Creston	S-3	187
					Creston	Lincoln	S-3	158
2-6-12	Lincoln	Burlington	S-3	345	Lincoln	Creston	S-3	158
					Creston	Burlington	S-3	187
25-7	Chicago	Creston	S-1	394	Chicago	Burlington		206
					Burlington	Creston	R-5	188
4-30	Creston	Chicago	S-1	394	Creston	Burlington	R-5	188
					Burlington	Chicago		206
77-79 (Frt.)	Galesburg	Creston	O-1-A	230	Galesburg	Ottumwa	O-2	117
70-74 (Frt.)	Creston	Galesburg	O-1-A	230	Ottumwa	Creston		113
					Creston	Ottumwa	O-2	113
					Ottumwa	Galesburg		117
			(St. Joseph-Brookfield-Hannibal.)					
14-16	St. Joseph	Hannibal	S-2	206	St. Joseph	Brookfield	S-2	102
					Brookfield	Hannibal	S-1	104
15-17	Hannibal	St. Joseph	S-2	206	Hannibal	Brookfield	S-1	104
					Brookfield	St. Joseph	S-2	102
			(Omaha-St. Joseph-Kansas City.)					
20-22	Omaha	Kansas City	P-5	197	Omaha	St. Joseph	P-1	133
					St. Joseph	Kansas City	S-2	64
21-23	Kansas City	Omaha	S-2	197	Kansas City	St. Joseph	S-2	64
					St. Joseph	Omaha	S-2	133
72 (Frt.)	Omaha	Kansas City	O-1-A	197	Omaha	St. Joseph	R-4	133
					St. Joseph	Kansas City	R-S	64
75 (Frt.)	Kansas City	Omaha	O-1-A	197	Kansas City	St. Joseph	R-5	64
					St. Joseph	Omaha	R-4	133

ton the savings in enginehouse expense at intermediate terminals has exceeded the fuel savings. To a certain extent increased attention at final terminals, more careful inspection at stations en route, the disposition of ashes when ashpans are cleaned away from regular terminals and other conditions necessitate additional expense. At not taking into account the standby losses occasioned when locomotives have their fires knocked at intermediate terminals and are later held under steam waiting for call. Every time a locomotive goes to a terminal there is more or less unavoidable waste of coal in keeping up steam pressure and direct loss to the ash pit. Before leaving,

Table II.—Summary of savings effected by long runs (Lines east)

Train Numbers	Terminals Between	Force Reductions	Fuel Savings	Total Approx. Savings Per Mo.	Engines Released For Other Service
Passenger Service					
51-52-47-48-49-50	Chicago & St. Paul	$1,950	$450	$2,400	2-Pacific Type C. B. & Q., Class S-2.
47-48-51-52	St. Louis & Galesburg	345	330	675	3-10 Wheel Type, C. B. & Q. Cl. K-10
55-56	Kansas City & Galesburg	296 (X)	165	461	1-Pacific, C. B. & Q., Class S-2
3-59-2-6-12	Burlington & Lincoln				
4-30	Chicago & Creston	550	495	1,045	4-Pacific, C. B. & Q., Class S-3
14-15-16-17	Hannibal & St. Joseph	...*	330	330	1-Pacific, C. B. & Q., Class S-2
20-21-22-23	Kansas City & Omaha	150	330	480	1-Pacific, C. B. & Q., Class S-2
Total		$3,291	$2,100	$5,391	12 Engines
Freight Service					
72-75	Kansas City & Omaha	None	178	178	1-Prairie, Class R-5
70-74-77-79	Creston & Galesburg	None	320	320	4-Mikado, Class O-2
Total		...	$498	$498	5 Engines

Grand Total Savings (Lines East)—$5,889 per Month.
Total Engines Released (Lines East)—17 Engines.

*Payroll Saving Included in (X)

many intermediate terminals, however, the operations of inspecting and caring for locomotives have been greatly reduced in magnitude so that a net saving for the system is obtained as shown in the tables. The work saved at intermediate terminals consists of inspection, cleaning, the fireman almost always throws on a few shovelfuls of coal to make sure that there will be steam enough to move the locomotive over the ash pit and, in heading, the hostler usually throws on a little more fuel for the same reason. All of this coal, together with other unburned coal in the

Table III.—Long engine runs on the C. B. & Q. (Lines west)

(Lincoln-McCook-Denver.)

Train Nos.	Present assignment: Present Terminal Initial	Present Terminal Final	Class of loco.	No. of miles	Former Assignment: Former Terminal Initial	Former Terminal Final	Class of loco.	No. of miles
3-5-9	Lincoln	McCook	B-1	230	Lincoln	Hastings	S-2	98
					Hastings	McCook		132
3-9	McCook	Denver	B-1	255	McCook	Akron	S-3	143
					Akron	Denver		112
6-2	Denver	Lincoln	B-1	485	Denver	Akron	S-1	112
					Akron	McCook		143
			S-1	...	McCook	Hastings	S-2	132
					Hastings	Lincoln		98
22	McCook	Lincoln	S-1	230	McCook	Hastings	S-3	132
					Hastings	Lincoln	S-1	98
	(Wymore-McCook-Denver.)							
15-17	Wymore	McCook	S-2	228	Wymore	Red Cloud	S-1	108
					Red Cloud	McCook	S-1	120
15-17	McCook	Denver	S-1-A	255	McCook	Akron	S-1	143
					Akron	Denver	S-1	112
14-16	Denver	McCook	S-1	255	Denver	Akron	S-1	112
					Akron	McCook	S-1	143
14-16	McCook	Wymore	S-1	228	McCook	Red Cloud	S-1	120
					Red Cloud	Wymore	S-2	108
	(Alliance-Sheridan.)							
41-43	Alliance	Sheridan	S-3	333	Alliance	Edgemont	S-3	111
					Edgemont	Sheridan	...	222
42-44	Sheridan	Alliance	S-3	333	Sheridan	Edgemont	S-3	222
					Edgemont	Alliance	...	111
	(Denver-Casper-Billings.)							
29	Denver	Casper	S-3	339	Denver	Cheyenne	S-3	120
					Cheyenne	Casper		119
29	Casper	Greybull	S-2	202	Casper	Greybull	S-2	202
29	Greybull	Billings	S-2	127	Greybull	Billings		127
30	Billings	Casper	S-1	329	Billings	Greybull	S-1	202
					Greybull	Casper		127
30	Casper	Denver	S-3	...	Casper	Cheyenne	S-3	...
					Cheyenne	Denver		...
	(Alliance-Seneca-Ravenna.)							
Pool† (Frt.)	Alliance	Ravenna	O-1-A	238	Alliance	Seneca	O-1-A	108
					Seneca	Ravenna		130

†There were 20 O-1-A engines in this pool running between Alliance and Seneca and Seneca and Ravenna. Since running these engines through from Alliance to Ravenna and return the pool has been reduced to 18 O-1-A engines.

knocking and rebuilding fires, washing boilers and normal repair work by enginehouse maintenance forces.

Enginehouse and fuel savings

The fuel savings shown in the tables are conservative, being based quite largely on the number of fires saved and firebox, goes into the ash pit when the fire is knocked. This loss is in direct proportion to the frequency with which the locomotives have to pass over the ash pit for cleaning.

More coal is saved in winter than in the summer months owing to increased radiation losses and the necessity of

keeping locomotives, not in the enginehouses, fired up to prevent freezing.

Maintenance standards kept high—Lubrication

A high standard of maintenance and consequently high mileage per engine failure is responsible in no small measure for the success of the Burlington in inaugurating long engine runs. The present excellent condition of Burlington locomotives engaged in running over two or more divisions has been brought about by tightening up in the work of inspection, and making minor repairs promptly before defects have time to develop and possibly cause failures. Another contributing factor is the general improvement program carried out at the various shops on the system whereby locomotive parts such as frames which have shown themselves to be weak and a frequent source of failure have been strengthened by putting in heavier sections. Old type cylinders subject to breakage between the valve chambers and frames have been replaced by improved modern designs.

The question of proper lubrication is important to the success of long engine runs and the way in which this is handled on the Burlington may be illustrated by the practice on locomotives running between Chicago and St. Paul, Minn. Three-pint lubricators are used on most of the locomotives in question and when they leave the Chicago terminal the lubricator is full and the engineman has 4½ pints in the tallow pot in addition. At Savanna, Ill., a service man meets the locomotive at the station and fills the lubricator, also the side and main rod grease cups. The same operation is repeated at Grand Crossing, Wis. Six pints of black or engine oil is provided. On the run from Chicago to Creston, Iowa, the lubricators are refilled at Burlington, Iowa. On this run the engineman starts out with five pints of valve oil in addition to the three pints in the lubricator. He is furnished with eight pints of black or engine oil.

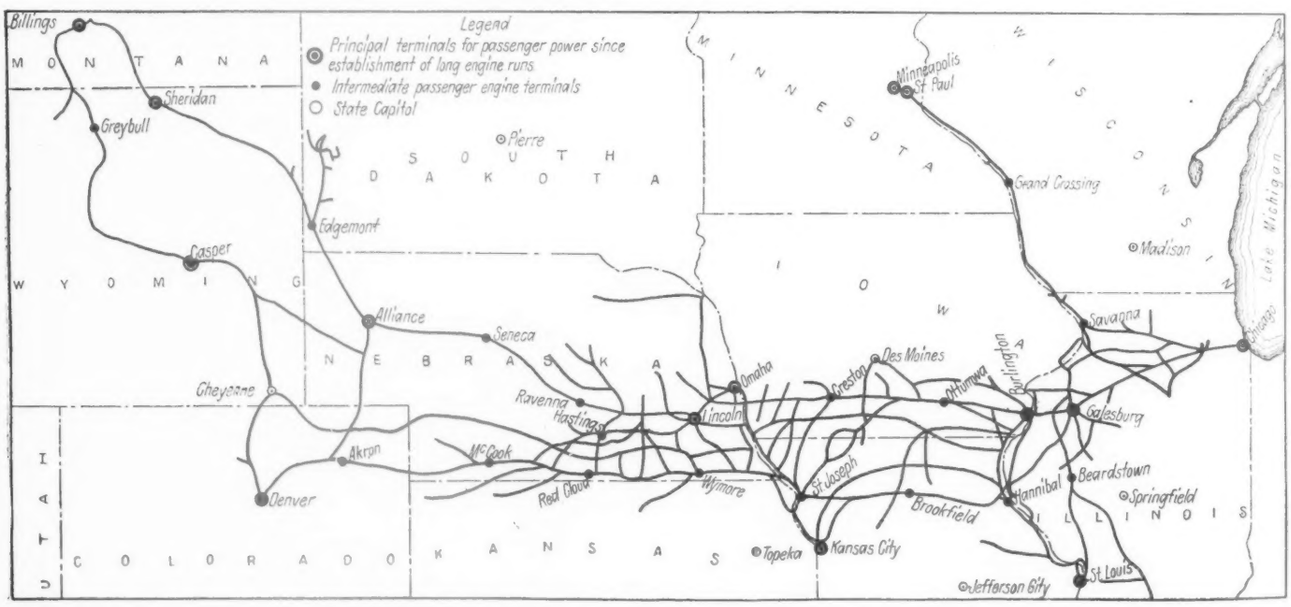
Table IV.—Summary of savings effected by long runs (Lines west)

Train Numbers	Terminals Between	Force Reductions	Fuel Savings	Total Approx. Savings Per Mo.	Engines Released For Other Service
Passenger Service.					
3-5-9-15-17 2-6-14-16-22	Lincoln & Denver Wymore & Denver	$706	$367	$1,073	7-Pacific type, C. B. & Q., Class S-1
29-30	Denver & Casper Casper & Billings	120	235	355	1-Pacific type, C. B. & Q., Class S-1
41-42-43-44	Alliance & Sheridan	440	270	710	3-1 Pacific type, C. B. & Q., Cl. S-2 2 Mountain type, C. B. & Q., Cl. B-1
Total		$1,266	$872	$2,138	11 Engines
Freight Service.					
Pool	Alliance & Ravenna	$1,276	$123	$1,399	2-Mikado type, C. B. & Q., Cl. O-1-A
Total		$1,276	$123	$1,399	2 Engines

Grand Total Savings (Lines West)—$3,537 per Month.
Total Engines Released (Lines West)—13 Engines.

Approximately 40 per cent of the locomotives used in long runs on the Burlington are equipped with Hulson grates which are now the system standard and which are being applied to the balance of the power as rapidly as practicable. Both trial and service tests of these grates showed that they aid materially in enabling coal-burning locomotives to run past intermediate terminals where the locomotives formerly stopped to receive enginehouse attention, including new fires. On account of the rocking feature of these grates experience showed that the fires were not broken up in shaking, and in fact it was possible to remove just the right amount of ash from the bottom of the grates by a light shaking, thus keeping the fires at the proper thickness. This feature, in conjunction with the 55 per cent air opening, practically prevented clinker

Hulson grates aid long runs; now standard on system



Map of the Burlington System showing the principal terminals handling passenger power since long runs have been established

formation with any of the coals burned. The grates proved popular with the crews owing to the ease of shaking which also encouraged firemen to shake their grates frequently and to keep the fires in a good clean condition.

The possibilities in the way of long fire life were indicated by two tests conducted in the latter part of 1923, in one of which Engine 2850 made 1,492 miles before the fire was knocked, the life of this fire being 121 hours. In the other case Engine 2855 made 2,645 miles with a single fire, the life of which was 183 hours. The following is a detailed report of the performance of these two engines during the periods referred to:

Life of fire on engine 2850—Equipped with Hulson grates

Engine out of shops, West Burlington, Iowa.....October 17
Fired up at Burlington enginehouse, at 10 a. m.....October 18
Trial run to New London and return (total 50 miles).....October 19

(Fire not cleaned)

Called for No. 4 at 11 p. m.....October 19
Arrived at Chicago at 6:37 a. m.....October 20

(Ash pan cleaned; fire not cleaned)

Called for No. 11 at 11 a. m.....October 20
Arrived at Burlington at 6:40 p. m.....October 20

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 11 p. m.....October 20
Arrived at Chicago 6:37 a. m.....October 21

(Ash pan cleaned; fire not cleaned)

Called for No. 11 at 11 a. m.....October 21
Arrived at Burlington at 6:40 p. m.....October 21

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 11 p. m.....October 21
Arrived at Chicago at 6:37 a. m.....October 22

(Ash pan cleaned; fire not cleaned)

Called for No. 11 at 11 a. m.....October 22
Arrived at Burlington at 6:40 p. m.....October 22

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 11 p. m.....October 22
Arrived at Chicago at 6:37 a. m.....October 23
Called for No. 11 at 11 a. m.....October 23
On despatcher's order, held for No. 49.....October 23
Fire knocked for boiler washout.....October 23
Engine on and off clinker pit in 4 min.
Total running time.....57 hr., 40 min.
Total enginehouse time.....63 hr., 20 min.
Total life of fire.....121 hr.
Total mileage.....1,492

Life of fire on engine 2855—Equipped with Hulson grates

Called for No. 71, Burlington, Iowa, to Ottumwa, at 5:15 p. m..November 20

(74 miles, 25 cars, 1,200 tons)

Arrived at Ottumwa, at 8:45 p. m.....November 20

(Ash pan cleaned; fire not cleaned)

Called for No. 76, at 10:45 a. m.....November 21

(74 miles, 31 cars, 960 tons)

Arrived at Burlington at 3:10 p. m.....November 21

(Ash pan cleaned; fire not cleaned)

Called for No. 7, Burlington, Iowa, to Creston, at 6:55 a. m....November 22

(188 miles, 6 cars of mail)

Arrived at Creston at 11:30 a. m.....November 22

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 2:40 p. m.....November 22

(188 miles, 9 passenger cars)

Arrived at Burlington at 9:30 p. m.....November 22

(Ash pan cleaned; fire not cleaned)

Called for No. 7 at 6:55 a. m.....November 23
Arrived at Creston at 11:30 a. m.....November 23

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 2:40 p. m.....November 23
Arrived at Burlington at 9:30 p. m.....November 23

(Ash pan cleaned; fire not cleaned)

Called for No. 7 at 6:55 a. m.....November 24
Arrived at Creston at 11:30 a. m.....November 24

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 2:40 p. m.....November 24
Arrived at Burlington at 9:30 p. m.....November 24

(Ash pan cleaned; fire not cleaned)

Called for No. 7 at 6:55 a. m.....November 25
Arrived at Creston at 11:30 a. m.....November 25

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 2:40 p. m.....November 25
Arrived at Burlington at 9:30 p. m.....November 25

(Ash pan cleaned; fire not cleaned)

Called for No. 18, Burlington to Chicago, at 9:10 a. m.....November 26
Arrived at Chicago at 2:40 p. m.....November 26

Called for No. 15, Chicago to Creston, at 9 p. m.....November 26
Arrived at Creston at 5:40 a. m.....November 27

(Ash pan cleaned; fire not cleaned)

Called for No. 4 at 2:40 p. m.....November 27
Arrived at Burlington at 9:30 p. m.....November 27

(Ash pan cleaned; fire not cleaned)

Called for No. 12 at 3:05 a. m.....November 28
Arrived at Chicago at 9 a. m.....November 28
Engine held for washout.....November 28
Fire was knocked in 10 min.....November 28
Total running time.....80 hr. and 30 min.
Total enginehouse time.....102 hr., 30 min.
Total life of fire.....183 hr., 45 min.
Total mileage.....2,645

In the test of Engine 2855, it performed a variety of service, handling passenger, mail and freight trains between Chicago, Burlington and Creston, Iowa. The fire was finally knocked after 2,645 miles to permit a thorough boiler washout. The life of the fire was 183 hr., 45 min., and it was the consensus of opinion that it could have continued indefinitely, burning the average run of coal on these divisions. There was a saving of the knocking and building of 12 fires. Successful test runs of a similar character were made on the Brookfield division where the water is bad and locomotives must be held for a washout every 400 miles.

Table V.—Increase in daily mileage of passenger locomotives

Division	Train numbers	Daily train miles	No. of engines now used	No. of engines formerly used
Alliance-Sheridan	41-42-43-44	1,332	6	8
Denver-Billings	29-30	1,344	5	7
St. Louis-Galesburg	47-48-51-52	832	4	7
Nebraska District	(3-5-9-2-6-22) (15-17-14-16)	4,189	18	25
Galesburg-Kansas City..	55-56	650	2	3
Hannibal-St. Joseph.....	14-15-16-17	824	3	4
Omaha-Kansas City.....	20-21-22-23	780	4	5
Chicago-St. Paul.....	47-48-49-50-51-52	2,586	7	9
Lincoln-Burlington	2-3-5-6-9-12	2,070	9	13
		14,607	58	81

Former average daily locomotive mileage	180
Present average daily locomotive mileage	252
Miles per day increase	72
Percentage increase	40
Locomotives released to other service	23

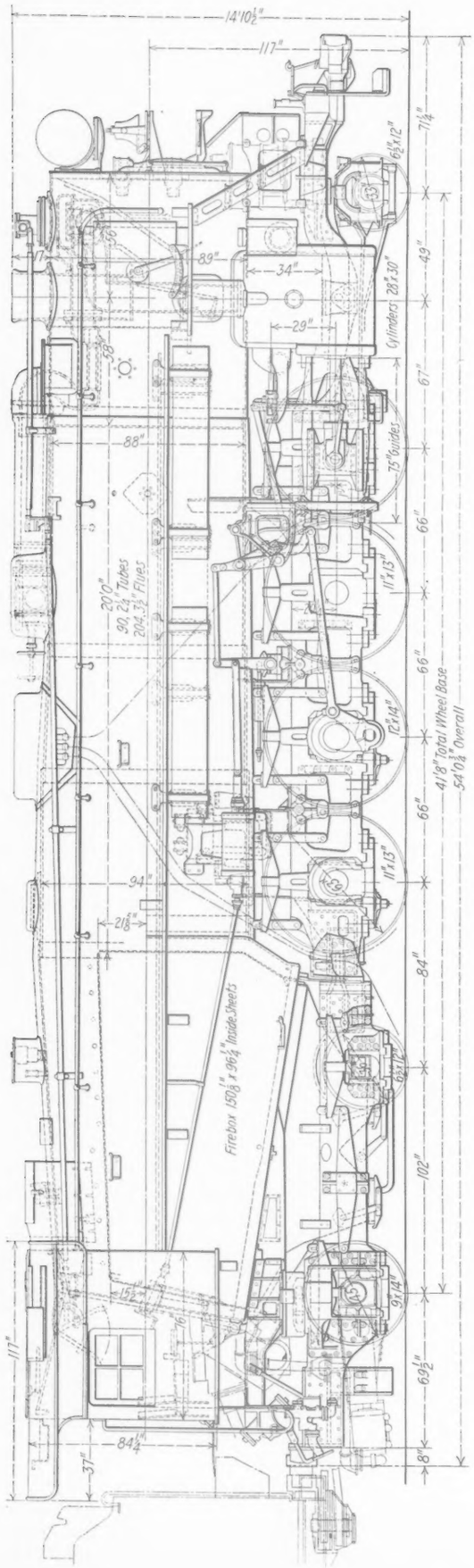
From an examination of this record it will be evident that engine 2850 made seven trips in regular passenger service between Chicago and Burlington, Iowa, with a single fire, and then the fire was knocked because the locomotive was scheduled to take No. 49 into a bad water district making it necessary to wash out the boiler. In connection with the ratio of running to enginehouse time, it is interesting to note that Engine 2850 was in service 47.5 per cent of the time, which is considerably better than the national average of 33⅓ per cent.

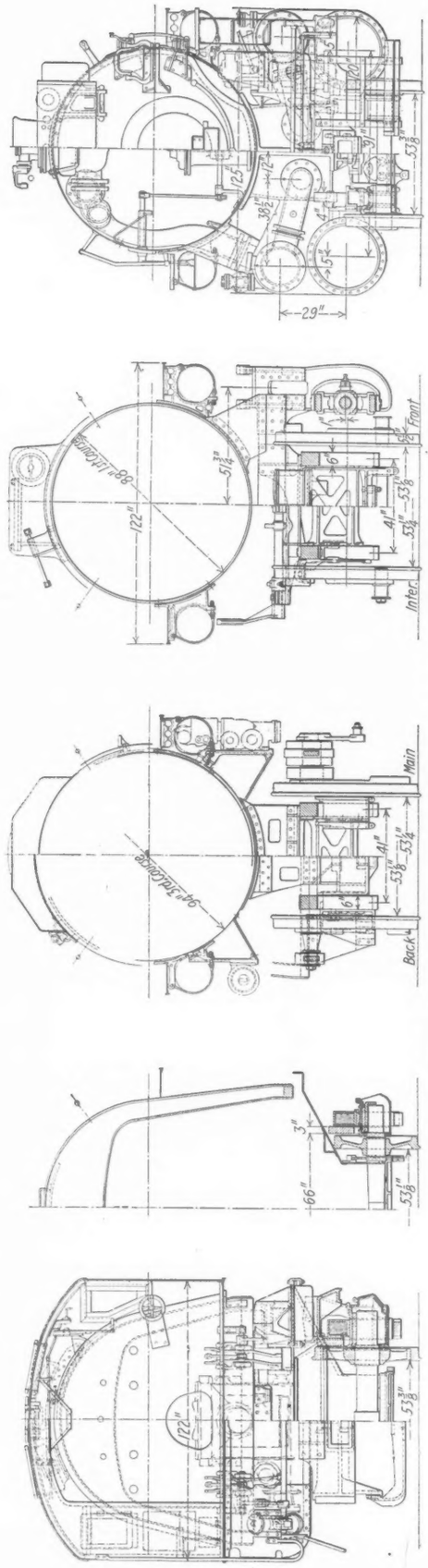
No firing tool was used on Engine 2850 during the runs, the fire being kept clean by shaking the grates lightly. On arrival at a terminal the fire was shaken and enough coal added to keep it in shape while in the enginehouse. There was no formation of clinkers and the thickness of the fire at the end of the run is indicated by the fact that only four minutes were required on the cinder pit.

The grates were shaken four or five times on each trip and at no time were they difficult to shake.

The coal varied from good to dirty mine-run, from Southern Illinois. This test indicate the better combustion obtained with the 55 per cent air opening, and that the grates can be shaken lightly under a thin fire without disturbing the fire bed. The fine ash, being sifted from underneath the fire as it formed, resulted in a clean fire at practically all times.

THE LEGISLATURE OF MISSOURI has passed a bill providing that water glasses must be so placed on locomotives that both the engineman and fireman will be able to see the water level from their seats.





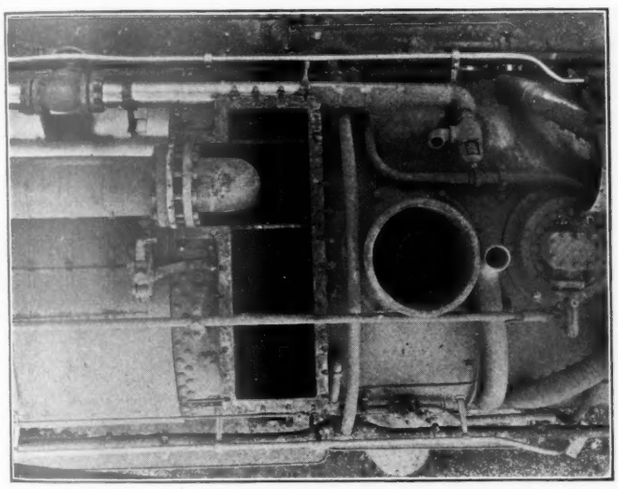
Elevation and cross sections of Lima 2-8-4 type locomotive

High power 2-8-4 type locomotive

Has 100 sq. ft. of grate, 4-wheel trailer truck and 60 per cent maximum cut-off—Tractive force with booster, 82,600 lb.

THE Lima Locomotive Works, Inc., late in January, completed a 2-8-4 type freight locomotive with 100 sq. ft. of grate area. This locomotive, which is owned by the builder, was placed in service on the Boston & Albany in February. It weighs 385,000 lb., of which 248,200 lb. is on the drivers and 101,300 lb. on the four-wheel articulated trailing truck. It carries 240 lb. boiler pressure and, with a maximum cut-off of 60 per cent, develops a tractive force of 69,400 lb. Including the booster, which drives on the rear pair of trailing wheels, the total tractive force is 82,600 lb.

The principal objectives in the design of this locomotive were the development of high horsepower capacity and



Looking down on the top of the smoke box—The superheated steam line of the turret is shown at the top of the picture

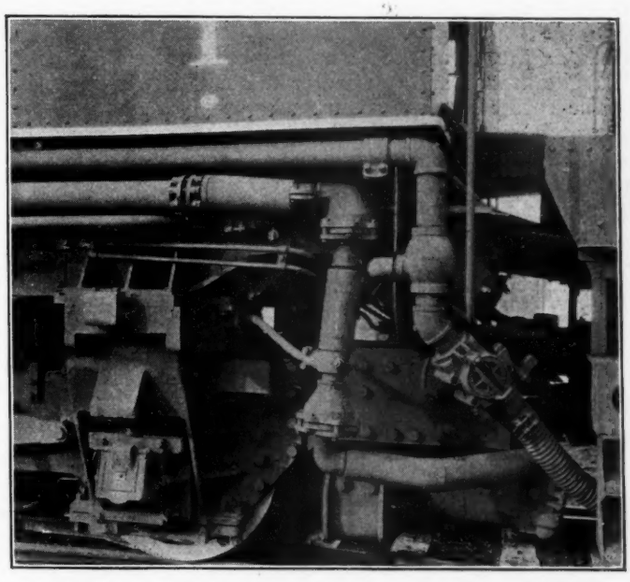
improved economy in the use of fuel. It may be considered a logical step forward in carrying out the principles on which this builder has been working since the inception of the design of Locomotive 8000 which was built for the Michigan Central in 1922, and of which design over 300 have since been built for various parts of the New York Central System. A comparison of the more important dimensions and proportions of the two locomotives will serve to indicate the methods by which it is expected to obtain the increased horsepower and higher fuel economy. Such a comparison will be found in the table.

It will be seen that the cylinders are the same size on both locomotives. This suggests that an increase in tractive force was not the primary objective, although some increase has been possible because of the smoother torque curve and the resulting lower factor of adhesion which the employment of limited cut-off made possible. The outstanding difference in proportions is in the size of the grate, the new 2-8-4 locomotive having approximately 50 per cent more grate area than did the earlier Mikado. It will also be noted that the boiler is somewhat larger in other respects. The total evaporative heating surface has been increased about 12 per cent and there is an 18 per cent increase in the amount of superheating surface, resulting in an increase of combined evaporative and superheating surface of about 13½ per cent. While

Comparison of Locomotive A-1 and Locomotive 8000

	A-1	8000
Type	2-8-4	2-8-2
Cylinders, diameter and stroke	28 by 30	28 by 30
Cut-off in full gear	60 per cent	Full stroke
Boiler pressure	240 lb.	210 lb.
Weights in working order:		
On drivers	248,200 lb.	248,000 lb.
On front truck	35,500 lb.	29,000 lb.
On trailing truck	101,300 lb.	58,000 lb
Total engine	385,000 lb.	335,000 lb
Diameter drivers	63 in.	63 in.
Heating surfaces:		
Firebox, incl. arch tubes	337 sq. ft.	291 sq. ft.
Tubes and flues	4,773 sq. ft.	4,287 sq ft.
Total evaporative	5,110 sq. ft.	4,578 sq. ft.
Superhating	2,111 sq. ft.	1,780 sq. tt.
Comb. evaporative and superheating	7,221 sq. ft.	6,358 sq. ft.
Grate area	100 sq. ft.	66.4 sq. ft.
Net gas area through tubes and flues	1,536 sq. in.	1,348 sq. in.
Rated tractive force:		
Engine	69,400 lb.	66,700 lb.
Engine and booster	82,600 lb.	77,700 lb.
Factor of adhesion	3.58	3.72

these figures indicate a considerable increase in capacity for heat absorption, the greatest increase in boiler capacity will undoubtedly result from the ability to release at the grate a large aggregate amount of heat at exceptionally



Furnace expansion and trailer lateral motion bearings

low rates of combustion. This favors both high boiler capacity and high fuel economy.

The other principal factor in this design for the improvement of fuel economy is the employment of the limited maximum cut-off which is accompanied by an increase in boiler pressure primarily to offset the reduction in the ratio of mean effective pressure to initial pressure resulting from the limited cut-off. While the

value of the limited cut-off as an economy factor is more apparent within the speed range at which full-stroke cut-off locomotives are ordinarily operated, it has also been found that a significant reduction in water rate occurs throughout the entire speed range. For freight service, a very considerable percentage of the locomotive mileage is made in the speed range within which full-stroke locomotives operate at more than 60 per cent cut-off.

There is some tendency toward improved thermal efficiency because of the higher boiler pressure. Its principal effect, however, is to increase the tractive force over that of the full-stroke cut-off locomotive at speeds where less than 60 per cent cut-off is required. This means correspondingly increased horsepower at these speeds.

Aside from the proportions of the new locomotive, its construction embodies four important innovations in detail design.* These are the cast steel cylinders which have made possible a saving of 4,000 lb. in weight; the articulated four-wheel trailing truck which does not require rear frame extensions and has made possible a marked improvement in ash pan design; the articulated main rod which delivers its load on two outside crank pins instead of on one, and the simple port arrangement by which an unbalanced cut-off has been obtained in the two ends of the cylinders at starting, with a resulting increase in the smoothness of the starting torque curve.

Cast steel cylinders

This is not the first application of cast steel cylinders. It will be remembered that Locomotive 50,000 built in 1911 by the American Locomotive Company was equipped with cylinders of this material. The cylinders on Locomotive 50,000 called for the use of outside steam pipe connections, but the exhaust passages from the valve chamber were cored inside the body of the casting. In the case of the cylinders on the new locomotive, there are no steam passage connections from the valve chamber to the saddle proper. The only steam passages in the saddle are from the front and back faces of each half saddle inward and upward to the exhaust standpipe base. The cores for these passages are supported in the mold at each end, making the floating of the core very unlikely, and the walls of the passages are accessible should it be necessary to close a blow-hole by welding.

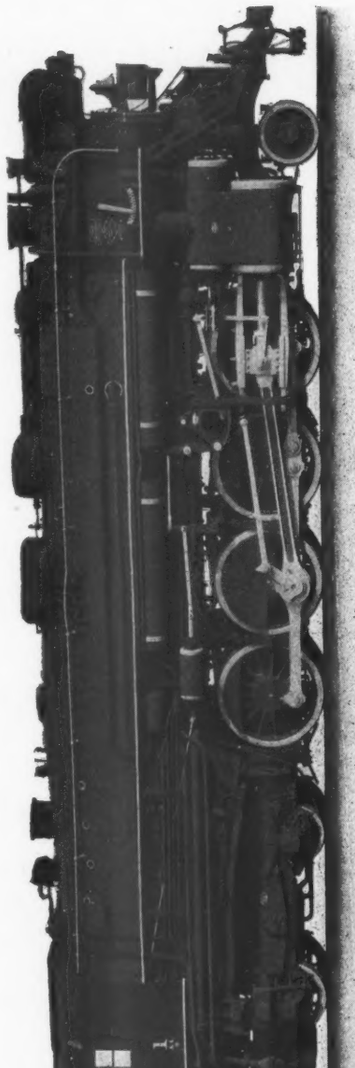
The photographs show clearly how connection is made from the valve chambers to the saddle exhaust passage by means of cast pipes which are bolted to openings in the valve chamber extension heads at one end and against the face of the saddle casting at the other. This construction leaves the designer free to distribute his metal in the connections between the saddle and the cylinder and valve chamber with one objective in mind—the strength and quality of the casting.

Before the design of the new locomotive was laid down, a cylinder and half-saddle of this design was cast, machined and pressure tested. As a result of the experience obtained from this casting, the cylinders for the new locomotive were cast with only minor changes in the pattern.

The four-wheel trailer truck

The articulated four-wheel trailing truck is a unique development in the design of the frame and the equalizer systems. This truck in effect forms a part of the main frame system, leaving no need for a rear frame extension back of the main frames. The main frames terminate just back of the rear pair of drivers. Between them is bolted a hinge casting of the Mallet type; a corresponding

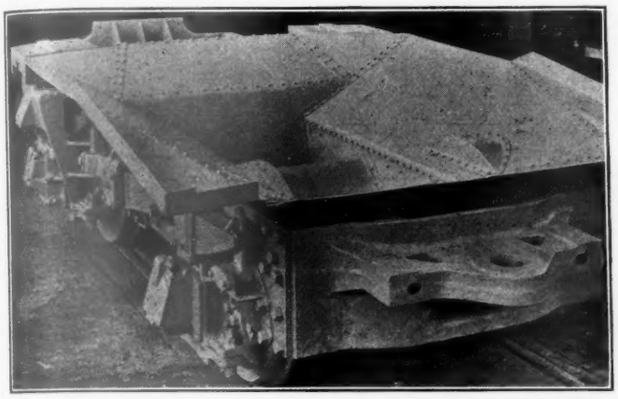
* These details and other features and combinations embodied in this locomotive are covered by patents or patents pending.



A departure from customary locomotive proportions—A grate area of 100 sq. ft. reduces the rate and improves the efficiency of combustion; a maximum cut-off of 60 per cent improves steam economy and increases horsepower output at medium and high speeds

hinge casting forms the front member of the trailer truck. The buffing and pulling stresses are thus transmitted directly through the trailing truck frames and the drawbar pocket forms a part of the rear trailer frame casting. These frames have a section of 3 in. by 17 in. where the rear frame casting is bolted between them and are 3 in. by 21 in. in section between the axles.

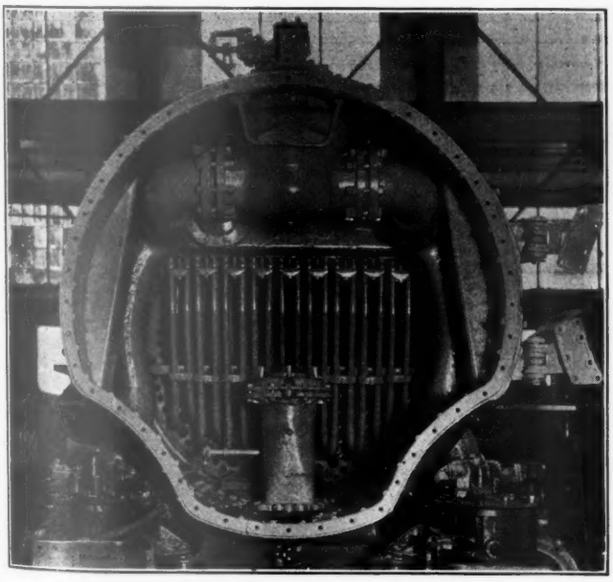
The vertical load is transmitted to the trailer truck at



The front end of the trailer truck, showing the ash pan in place

two points on each side: at the front corners of the trailer hinge casting, on the top surface of which rest extensions of the main frames, and at the rear corners of the firebox, each of which is supported on a combined expansion and self-centering lateral motion bearing. It will thus be seen that while the trailer truck is free to swing laterally about its hinge joint, its vertical alinement remains unchanged with respect to the main frames, of which, in effect, it forms a part.

The two journal boxes on each side of the trailer are

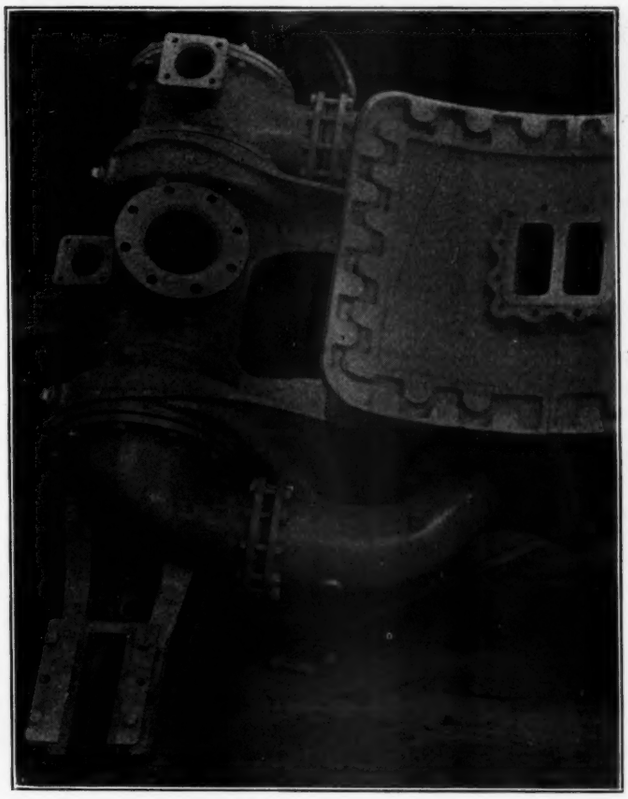


Interior of the front end during construction

equalized together, each side thus forming one point of the three-point spring suspension. The entire driving wheel base on each side of the locomotive is equalized together and the two sides are cross-equalized with the leading truck, so that the leading truck and the entire driving wheel base form the third point of the spring suspension.

One of the influences of this truck on the design of the locomotive, which, although incidental, is none the less important will be seen in the ash pan. The elimination of the rear frame extensions has removed one of the worst restrictions on securing a satisfactory slope of the ash pan side sheets and the space between the trailer axles has permitted the building of hoppers of unusually large capacity. Although the grate is unusually large, the ash pan provides but little less than one cubic foot of capacity per square foot of grate.

The ash pan, instead of being attached directly to the mud ring, is built into the trailer truck and when the trailer truck is removed from the locomotive the ash pan is removed with it. The width of the flare required to keep the ash pan under the firebox when the trailer is displaced laterally on curves also provides an unrestricted



The cast steel cylinder, showing the outside exhaust pipe connections

air opening all around between the ash pan and the mud ring.

In the absence of rear frame extensions from which the cab and a number of items of auxiliary equipment are supported, heavy cast steel cab brackets are attached to the back corners of the mud ring. Heavy lugs are cast below the back and sides of the mud ring at the corners to support these brackets, which also form the top members of the combined furnace bearers and trailer truck lateral motion bearings.

As has already been indicated, the booster drives on the rear trailer axle. This axle has 9-in. by 12-in. journals and 45-in. wheels. The front trailer axle is of standard M.C.B. type, with 6-in. by 12-in. journals and 36-in. wheels. The booster frame and cylinders are located back of the rear trailer axle and are suspended from the trailer frames by a cast steel yoke. The arrangement is shown in one of the photographs included in this article.

One of the greatest problems in connection with the use of the limited cut-off is to provide for the increase in the main crank pin and driving box loads which results from the high initial piston load. The solution of this problem has been attacked in an original manner in the new 2-8-4 type locomotive.

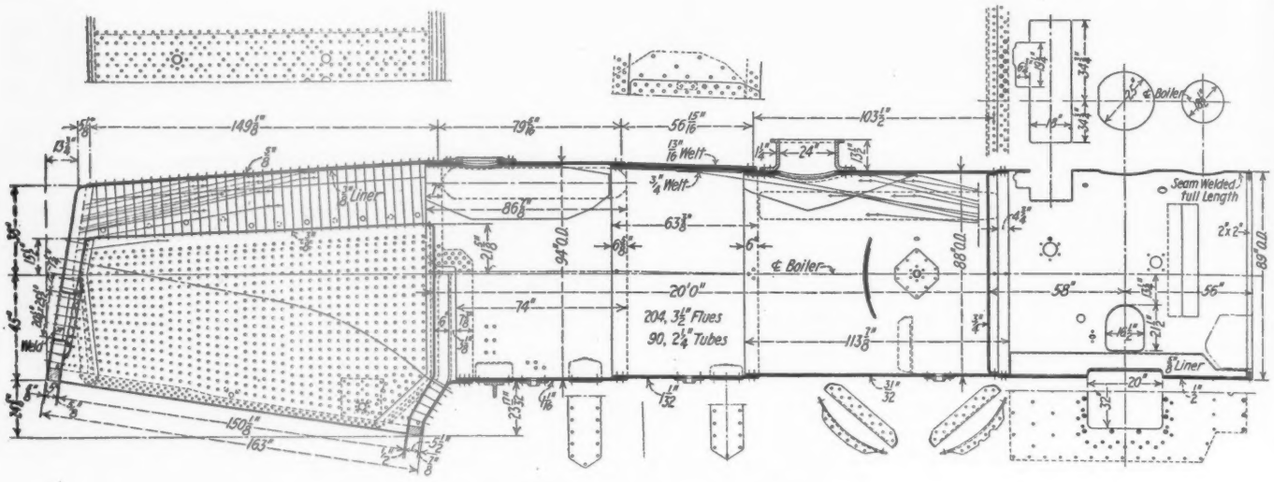
The driving rods

The main rod is built in two parts, one of which drives directly on the main crank pin, while the other carries back part of the load to the rear crank pin, thus relieving the main crank pin of one-quarter of the full driving load. This rod arrangement is shown in one of the photographs.

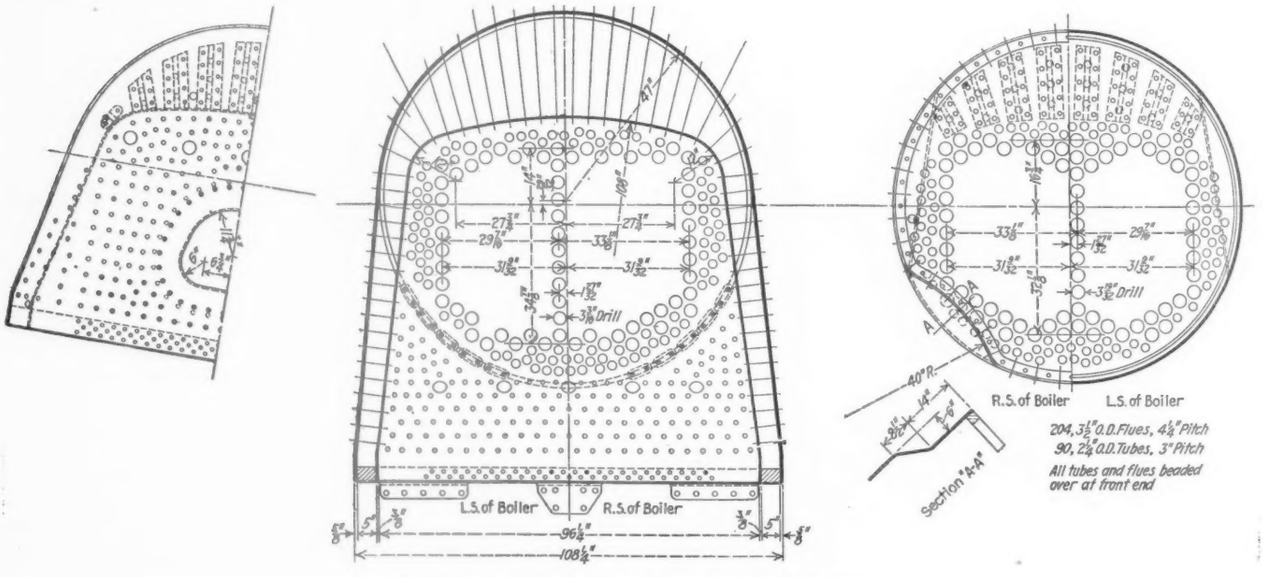
The back end of the main rod proper is forked to receive the parallel section of the main rod. With the two parts of the rod thus assembled, a heavy steel bushing is pressed into the forked end of the main rod proper, holding in place and providing a bearing for the parallel section of the rod. This bushing transmits directly from one section of the rod to the other, the portion of the load which is carried back to the rear wheel. Inside of the steel bushing is a floating bronze bushing which serves as a crank pin bearing. The usual side rod arrangement distributes the driving load forward from the main crank pin to the second and first crank pins. This arrangement, by relieving the main pin and reducing the size of the middle connection bearing made possible the same spread of cylinders, with 240 lb. boiler pressure as was formerly used with 200 lb. boiler pressure.

By the use of the floating bushing on the main pin, which may be pulled and replaced without removing the rod from the pin, it is expected that no difficulty will be encountered in enginehouse maintenance because of the weight and size of this main rod and that, indeed, the amount of work may actually be reduced.

Here again, as in the case of the cast steel cylinders, this rod arrangement was subjected to a service test of considerable duration on a 4-8-2 type locomotive before the design of the new locomotive was laid down. The experience thus obtained indicates that it is practicable.



Longitudinal section of the boiler

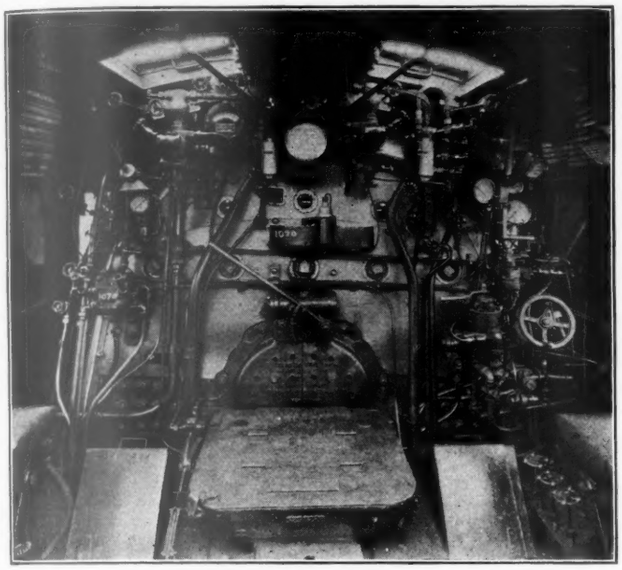


Sections through the firebox and smoke box

Unbalanced cut-off at starting

In addition to the auxiliary starting port which is regularly incorporated in the valve chamber bushings of

limited maximum cut-off locomotives, the cut-off at the front end of the cylinder is increased slightly over that at the rear end at starting and very slow speeds, by lengthening two of the ports in the front valve chamber bushing. The ports are 2-3/16 in. wide and in the front bushing two of the top ports are increased 7/16 in. in width toward the center of the valve piston chamber. This simple expedient effectively increases the period of steam admission at slow speeds, but as the speed increases the amount of steam admitted through the extension of the two ports gradually decreases until it becomes negligible in its effect on the cylinder events. For a nominal 60 per cent cut-off, the ports and valves are proportioned to give an actual cut-off of about 60 per cent in the rear end of the cylinder and 63 per cent in the front end.



The interior of the cab

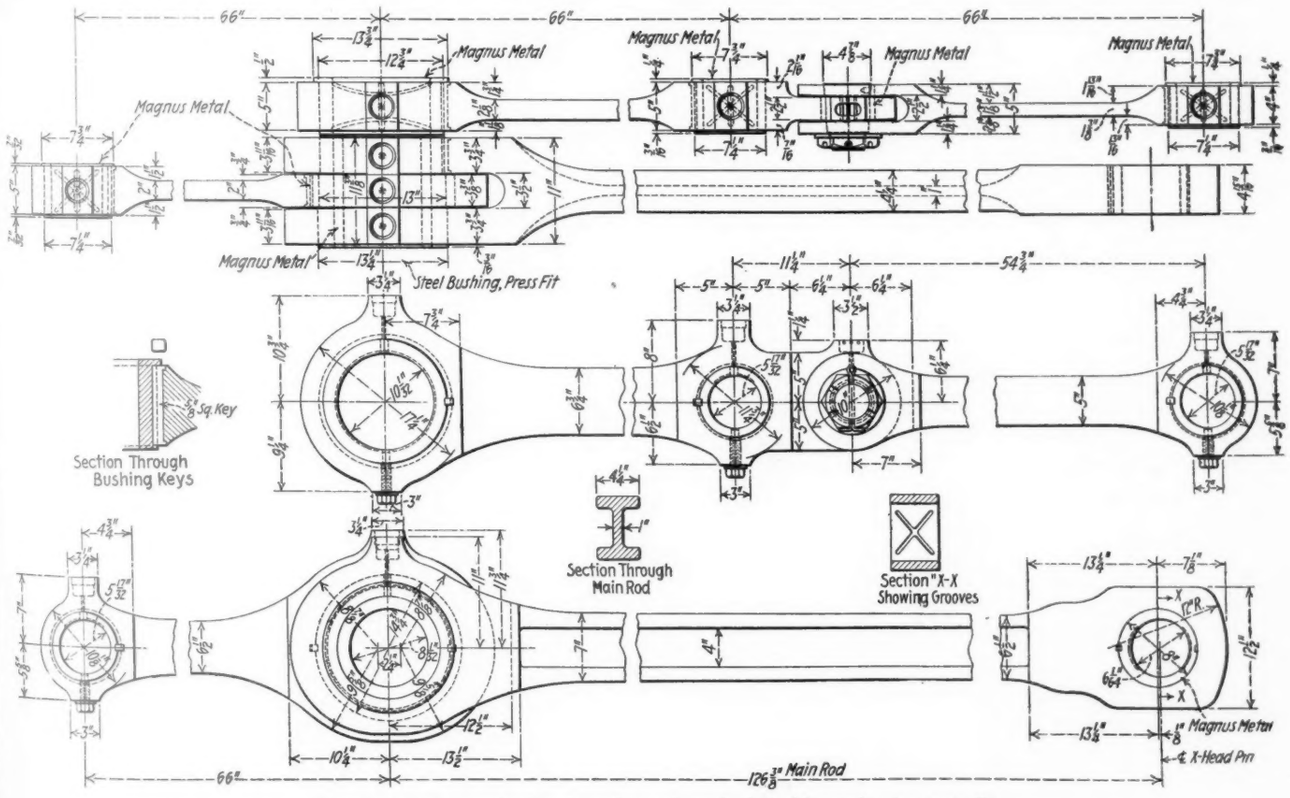
Boiler equipment

Aside from the size of the firebox, the boiler does not differ materially from the usual type of design. It is slightly larger in diameter and contains a somewhat different tube sheet layout with more heating surface than that of Locomotive 8000. The points of most interest are shown in the photographs. It will be seen that steam is taken from the dome through an outside dry pipe to the Type E superheater header at the rear of the smokebox.

The throttle is located in the smokebox just ahead of the smoke stack. The single steam connection from the superheater header to the throttle is cast integral with the throttle casing. Branch pipe connections are provided on either side of the throttle casing from which the branch pipes lead down inside the front end, passing outside at points just above the cylinders.

Above the superheater header, an opening in the top of the smokebox permits access to the superheater unit bolts which are placed with the nuts at the top. Unit joints may thus be tightened without the necessity of entering the front end.

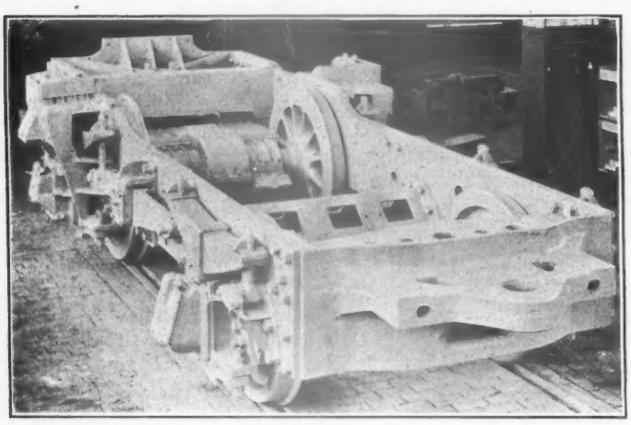
There are two turrets from which steam is distributed to the auxiliaries, both located over the top of the boiler just in front of the cab. One of these furnishes saturated steam to the injectors and lubricators. The other draws superheated steam from the throttle pipe connection to the superheater header for use in the air pumps, the feed water pump, the blower, grate shakers, stoker and headlight generator. The whistle, which also uses super-



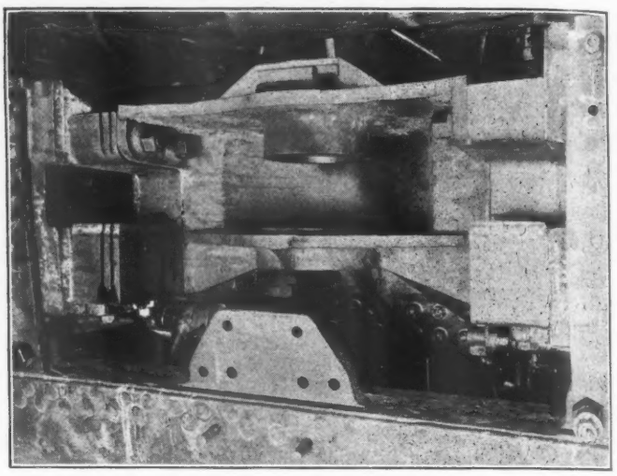
Details of the articulated main rod and the side rods (patented)

heated steam, has its connection welded directly on the steam pipe which feeds the turret. Steam for the booster is taken from the left branch pipe and its exhaust is carried up outside of the smokebox, opening to the atmosphere just in front of the smokebox.

It will be seen from the photographs that two channels of rectangular section are let into the sides of the smokebox. These are provided to take the exhaust steam pipes leading to the feed water heater, which is mounted on tops of the air compressors, one of which is mounted on a bracket on each side of the front deck casting.



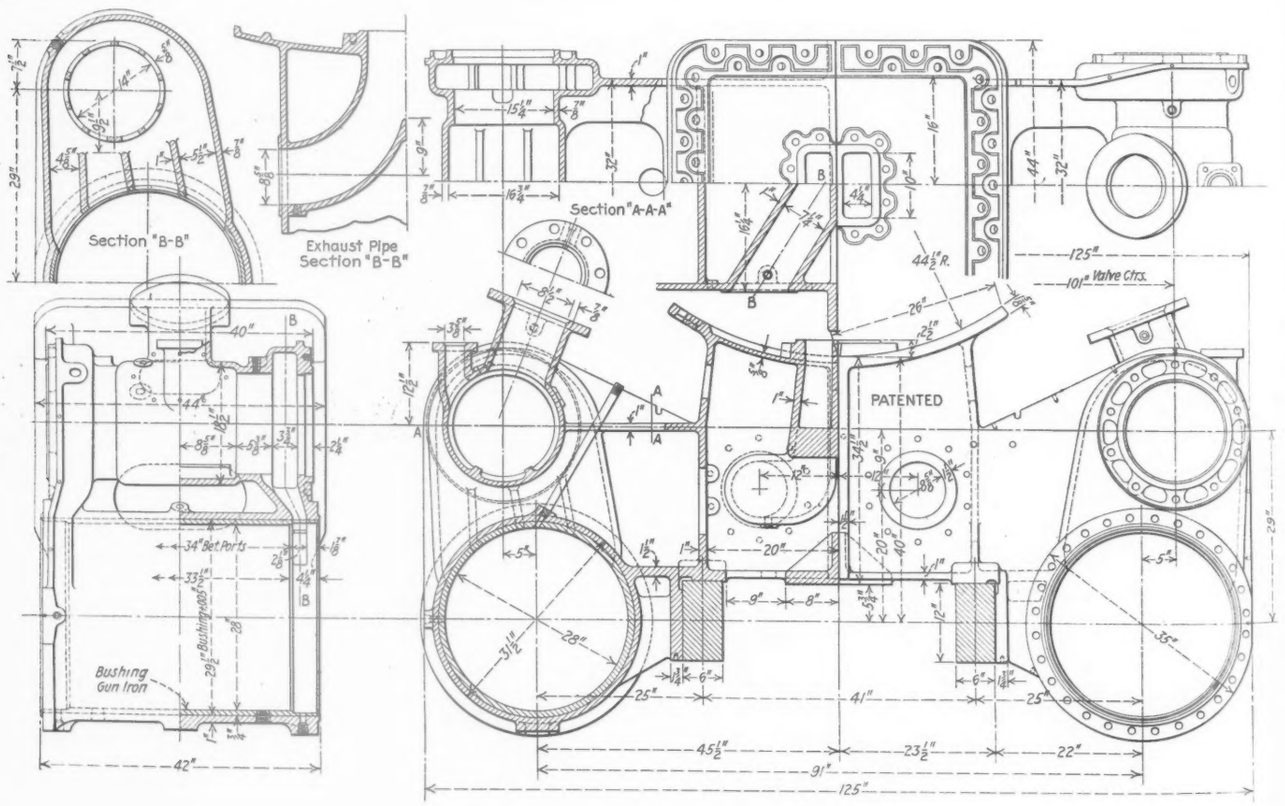
The trailer truck before the ash pan was applied—The side frames are 3 in. by 17 in. in section at the rear deck casting and 3 in. by 21 in. in section between the axles—The journal box pedestals are closed with binders



Looking into the trailer hinge casting at the rear ends of the main frames

Cab arrangement

In arranging the control valves and equipment located in the cab, considerable attention has been given to providing for the convenience and comfort of the engine crew. As far as possible all gages have been brought together in one location where the engineman can see them at a glance. A pneumatic whistle valve has been placed on the side of the cab where the engineman does not have to reach to operate it. The various valve handles have been grouped and labeled, with those most frequently



The design of the cast steel cylinders (patented)

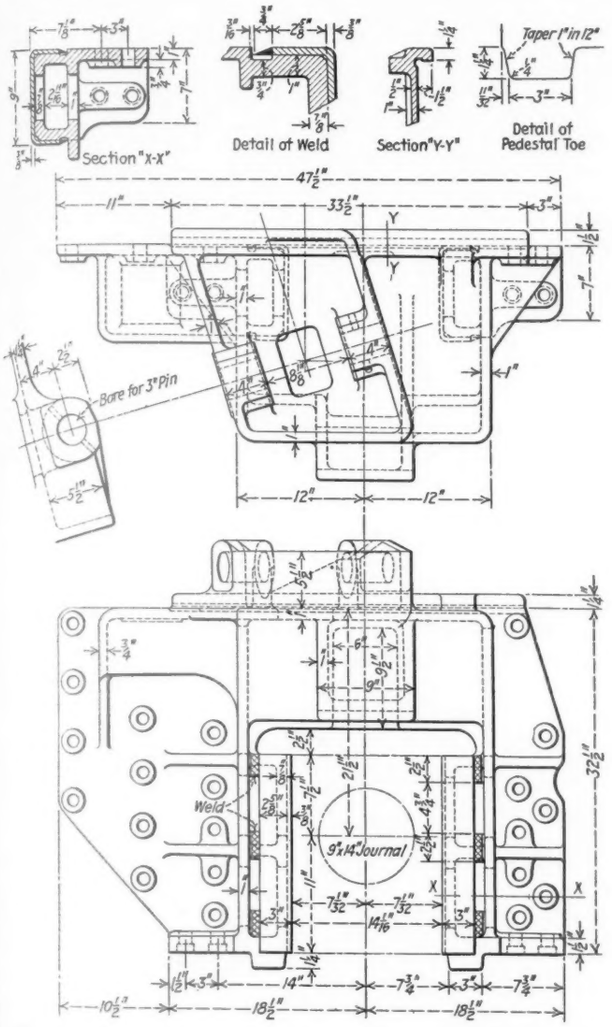
brackets in front of the front end, without projecting outside the surface of the smokebox shell. Recesses are also formed in the lower quarters of the front end door ring and in the sheets immediately back of it, to clear the

operated placed where they are most readily accessible.

Folding spring cushioned seats, the frames of which are supported on coil springs, are provided on both sides of the cab. Back of the fireman's seat is a locker for clothing.

Tractive force fixed by trial

In designing the locomotive considerable latitude was provided for the selection of the final working boiler pressure and maximum cut-off. This was done in order that the maximum cut-off might finally be determined as the result of trials in actual road service. To this end the



Combined rear trailer journal box and lateral motion bearing—the roller which revolves on a 3 in. pin, is geared to the self centering top bearing plate (patented)

locomotive was equipped with a variable exhaust nozzle, the design employed by the Paris, Lyons & Mediterranean having been selected as meeting the requirements of a thoroughly tested and practical device. This nozzle is not intended for manual control by the engineman, but its operating arm is secured to a graduated quadrant on the outside of the front end which permitted adjustments in exhaust nozzle area to be made as frequently as might be desired during the adjustment process without the necessity of entering the front end.

In developing the design of this locomotive, the builders set up the following requirements: That it must be able to handle the same train in drag freight service with 20 per cent less coal than is burned by the Locomotive 8000 design; that, in high speed freight service, it must pull the same train at the same speed as Locomotive 8000 with 12 per cent less coal, or deliver 10 per cent more drawbar pull for the same amount of coal. Experience with the locomotive so far indicates that it will fully meet and probably exceed these requirements. The locomotive is now undergoing tests in service, from which more complete data will later be available.

The principal dimensions and data are shown in the following table:

Type of locomotive	2-8-4
Service	Freight
Cylinders, diameter and stroke	28 in. by 30 in.
Valves, piston type, size	14 in.
Maximum travel	8¾ in.
Outside lap	2 7/16 in.
Exhaust clearance	1/4 in.
Lead in full gear	¼ in.
Cut-off in full gear, per cent	60
Weights in working order:	
On drivers	248,200 lb.
On front truck	35,500 lb.
On trailing truck	101,300 lb.
Total engine	385,000 lb.
Tender	275,000 lb.
Wheel bases:	
Driving	16 ft. 6 in.
Rigid	16 ft. 6 in.
Total engine	41 ft. 8 in.
Total engine and tender	82 ft. 6 in.
Wheels, diameter outside tires:	
Driving	63 in.
Front truck	33 in.
Trailing truck	36 in. and 45 in.
Journals, diameter and length:	
Driving, main	12 in. by 14 in.
Driving, others	11 in. by 13 in.
Front truck	6½ in. by 12 in.
Trailing truck	6½ in. by 12 in. and 9 in. by 14 in.
Boiler:	
Type	Straight top
Steam pressure	240 lb.
Fuel, kind	Bituminous
Diameter, first ring, outside	88 in.
Firebox, length and width	150⅛ in. by 96¼ in.
Height mud ring to crown sheet, back	60½ in.
Height mud ring to crown sheet, front	91¼ in.
Arch tubes, number and diameter	5, 3½ in.
Combustion chamber, length	None
Tubes, number and diameter	90, 2¼ in.
Flues, number and diameter	204, 3½ in.
Length over tube sheets	20 ft.
Tube spacing	3/4 in.
Flue spacing	3/4 in.
Net gas area through tubes and flues	1,536 sq. in.
Grate area	100 sq. ft.
Heating surfaces:	
Firebox, incl. arch tubes	337 sq. ft.
Tubes	1,055 sq. ft.
Flues	3,718 sq. ft.
Total evaporative	5,110 sq. ft.
Superheating	2,111 sq. ft.
Comb. evaporative and superheating	7,221 sq. ft.
Tender:	
Style	Rectangular
Water capacity	15,000 gal.
Fuel capacity	18 tons
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	64.2
Weight on drivers ÷ tractive force	3.58
Total weight engine ÷ comb. heat. surface	53.3
Boiler proportions:	
Tractive force ÷ comb. heat. surface	9.61
Tractive force × dia. drivers ÷ comb. heat. surface	605
Firebox heat. surface ÷ grate area	3.37
Firebox heat. surface, per cent of evap. heat. surface	6.60
Superheat. surface, per cent of evap. heat. surface	41.4
Tube length ÷ inside diameter	74.5
Comb. heat. surface ÷ grate area	72.2

THE METHODS OF TESTING BRITISH LOCOMOTIVE TIRES do not vary greatly from the methods used in this country. The British tires must not be too brittle or too soft and must have a tensile breaking stress of from 100,000 to 110,000 lb. per sq. in. and finally the steel from which they are made must pass a chemical test as to its content of sulphur and phosphorus. The tires are given a drop test which is not common practice in this country. One tire out of a lot of 50 is placed in an upright position in the base of the testing machine. A ton weight is raised and dropped on the edge of the tire from varying heights. For a tire weighing 950 lb., the weight is first dropped on the rim from a height of 5 ft., then from 10 ft. and finally the fifth blow is received from a height of 25 ft. The tire should not break or be unduly bent. If the diameter of a 950-lb. tire, measured from the point on which the blows fell, is reduced approximately 4 in., it is considered a good tire and the lot is passed as fit for service.

Railway motor car service on the C. G. W.*

By E. J. Brennan

Superintendent of motive power, Chicago Great Western, Oelwein, Iowa

IN the past year quite a few additional cars of the self-propelled type have been built for various railroads, and the Chicago Great Western has installed in the interim, one gas-electric car, two mechanical gear-driven, two-car trains and one steam car. The following data relate to these cars:

Gas-electric car M-300

Length of body	57 ft. 4 in.
Width	9 ft. 8⅝ in.
Weight	76,400 lb.
Baggage compartment	156 sq. ft.
Seating capacity	50
Type of body construction	steel
Standard A. R. A. journal bearings	4¼ in. by 8 in.

Two Sykes trains Nos. M-207, MT-208, M-209 and MT-210

Total length of motor car	46 ft. 10 in.
Total length of trailer	52 ft.
Width	8 ft. 6 in.
Weight of motor car	50,000 lb.
Weight of trailer	36,400 lb.
Baggage compartment	120 sq. ft.
Trucks equipped with Hyatt roller bearings.	
Seating capacity, motor car	30
Seating capacity, trailer	52
Type body construction	steel

The steam car has been developed by installing in the forward end of a McKeen car a tubular boiler, automotive type, working at a pressure of 500 lb. actuated by an oil-fired furnace. The engine in this unit is a six-cylinder compound having three low pressure cylinders, 7-in. bore by 7-in. stroke, and three high pressure cylinders having a 5-in. bore and a 7-in. stroke. This steam car has been handling a 35-ton combination mail and baggage car 55 ft. long making a total light weight of the train, 90 tons, or an average loaded weight of approximately 100 tons. This car has been in service between Oelwein, Iowa, and Ft. Dodge, a distance of approximately 260 miles a round trip each day, making 44 stops averaging 1¾ min. each on a schedule of 24.2 miles per hour.

The above reference to the steam car is preliminary to a final report which will be made by the builders after certain changes now being made to the engine and boiler have been completed and further data compiled at which time an official announcement will be made.

In the various units of equipment recently built, U. S. standards and steam railway practices have been followed in the general construction except the weights, which, generally speaking, are consistent with that type of equipment. In other words, the body design while it is of far lighter construction than standard railway coaches, combination cars, etc., is somewhat heavier than some of the more recently built rail motor cars.

Gas-electric car pulls heavy trailer

Our gas-electric car, although designed to haul a 35-ton coach or trailer, at this time is doing very much more. The car is and has been operating between Osage, Iowa, and Hayfield, Minn., in local main line passenger service, pulling a combination mail and express car weighing 54½ tons, a distance of 70 miles each day, or betwen McIntire and Hayfield, on a schedule of 26 miles an hour. The entire daily run for the car is only 104 miles, 70 of which, as stated, is traveled handling the 54½-ton combination car.

A few minor defects have developed on this unit but they have been very quickly corrected.

The control of the gas-electric car (described on page 371 of the August 30, 1924, *Railway Age*) is very dependable in that it is operated by a control similar to that of a steam locomotive. The first notch on the throttle operates an air starting system which allows the operator to stop the entire power plant by simply closing the throttle and to start the power plant and the car by opening the throttle when he is ready to proceed. This results in a noticeable economy in fuel consumption and maintenance, as gasoline engines develop carbon very rapidly when idling. This system of operation fits in well on steam railroads due to using locomotive enginemen for operators. This car is heated throughout by an Arcola hot water heater to which the builders have attached the water circulating system of the engine so that when the car is obliged to lay over during severe weather it is not necessary to drain it and the possibility of the radiator, piping, engine and other appurtenances freezing is eliminated.

The next two trains for the Chicago Great Western were purchased from the Sykes Company, St. Louis, and are similar to the preceding units except that they are considerably better owing to the inclusion of certain refinements incorporated as a result of our past experience. This refers to better construction of the body which did not materially increase the weight and an increase of at least 50 per cent in the strength of all driving parts. The trains referred to have been built somewhat longer than our previous units to provide more passenger seating capacity as well as additional baggage carrying facilities. A few changes have been made in the spark control of the engine which caused some trouble on account of not being fitted up substantially enough for the service in that a pressed fit was used which we were later obliged to weld solid in order to get it to hold. A roller bearing is used in the trucks of these cars which gave us trouble in the beginning owing to the inner sleeve of the bearing not being applied tight enough. Due to this the sleeves would work off the axle, come in contact with the outer bearing cap and generate sufficient heat to burn up the packing and lubrication, causing a complete failure. This can be overcome by adhering more closely to the mounting pressures recommended by the A. R. A. and used universally in American steam railroad shops. A better system of electric generation and storage by means of an axle lighting device and storage battery has been arranged for.

Sykes trains make 260 miles a day

One of the two Sykes trains referred to is running between Ft. Dodge, Ia., and Council Bluffs, a distance of 268 miles a day, every day. The motor car of the other train is operating between Oelwein and Ft. Dodge, a distance of approximately 260 miles a day, every day, and

*From a paper read on March 26, before the Minneapolis Section of the Society of Automotive Engineers.

is handling a mail and express car that weighs 35 tons light with an average of 10 tons of baggage and express, or equivalent to a 45-ton trailer, and is handling it very successfully.

On some of the units of equipment previously purchased, the cars were equipped with traction brakes which could not be operated in connection with standard steam railway automatic air brakes. These have been changed over, however, and we strongly urge from our experience that future units of motorized equipment be supplied with brakes that will operate in conjunction with the standard coaches, the foundation brake gear on some of the motor cars has been constructed too light, and not enough attention has been given to it generally with respect to clearances as the various parts wear. Instances have been known where, with the slightest amount of lost motion, the brake levers would strike some part of the truck frame before the average brake cylinder piston travel was experienced.

A small gas locomotive

The Chicago Great Western also has on order at this time, but its construction has not been completed as yet, a 25-ton six-wheel gasoline switching locomotive that it is proposed to operate on a branch line running from Cedar Falls Junction to Cedar Falls, Iowa. This locomotive is being built by the Baldwin Locomotive Works and is designed to pull about five loads and one coach at a maximum speed of 18 miles per hour.

These various units of equipment are indicative of the trend in design of motorized equipment on steam railroads. Three years ago we were talking single cars with a baggage space of approximately 50 sq. ft., seating capacity from 36 to 40 passengers, light weight approximately 15 tons, designed to run 40 miles an hour on level track. In this short period of time we have realized the 100-ton motorized train, traveling at 50 miles an hour.

It would be opportune to say at this time also that we are getting very fair service out of our older units of motorized equipment including the first Sykes train, the Service car and the McKeen cars.

Gasoline motor car data

Motor Car	Trailer	Period covered	Miles run	Cost per mile run, cents: Operation	Maint.	Total	Miles run per: Gal. gas.	Pt. oil
M-200	MT-201	Oct. 1922 to Jan. 1925.	59,304	22.92	11.30	34.22	4.01	13.62
M-205	MT-206	Aug. 1923 to Jan. 1925.	65,870	21.16	7.33	28.45	2.62	11.36
M-300	.....	Aug. 1924 to Jan. 1925.	18,914	23.29	4.68	27.97	2.14	10.42
M-400	.....	Nov. 1922 to Jan. 1925.	102,779	19.67	2.66	22.33	5.97	17.60
1001	.....	Oct. 1922 to Jan. 1925.	78,982	25.56	8.75	24.13	1.83	7.65
1002	.....	Jan. 1925...	1,270	21.67	6.33	28.00	1.23*	4.41
1000	1025	May 1923 to Jan. 1925.	35,410	28.08	20.79	48.87	1.56	3.19
1003	.....	July 1923 to Jan. 1925.	75,982	22.60	2.48	25.08	21.27	5.13

*1.23 gal. of fuel oil per mile.

A special maintenance department

The results given above in miles run and costs both for maintenance and operation, also the performance with respect to oil and gas consumption, suggests another very important thought and that is that the Chicago Great Western found it necessary to develop a gas engine department for the care of these cars and this department we know is to a great degree responsible for the successful performance of our motor cars. We have in our gas car organization a motor car expert who is on my immediate staff and whose jurisdiction extends over the entire system in seeing that the cars are maintained and assisting and instructing enginemen who wish to qualify as motor car operators. At our main shops at Oelwein we have a gas engine repair organization consisting of a foreman and several mechanics, helpers and apprentices who are engaged on gas engine work entirely. This refers to heavy and medium repairs particularly. For the light repairs on cars laying over at the engine terminal or roundhouse a specially trained gas engine mechanic is employed to see that the cars and their equipment are properly cared for and repaired.

The Chicago Great Western is now considering the building of a separate repair shop close to but somewhat removed from the main plant owing to the fire hazards existing. The building that we have in mind will be erected consistent with the type and the number of units of equipment that we now have. It will be equipped with special machinery for repairs to our motor cars.

In conclusion, in the construction of motor cars it is always well to bear in mind accessibility in order to facilitate repairs. This refers not only to the truck and body construction but to the engine as well.

Steam for enginehouse heating systems and blower lines*

By H. W. Williams

Superintendent of motive power, Chicago, Milwaukee & St. Paul, Tacoma, Wash.

LOW pressure steam is more efficient for heating purposes than is high pressure steam, for the simple reason that the heat content of one pound of steam at low pressure is but little less than at high pressure. For instance, a pound of steam at 125 lb. gage pressure contains 1192.2 B.t.u. while at 10 lb. gage pressure it contains 1160.4 B.t.u. Most engine terminals are at least partially equipped with vacuum return systems but unfortunately it is easier to extend live steam lines than it is the heating mains, consequently in most instances it will be found that the radiation supplied with live steam exceeds the original low pressure installation,

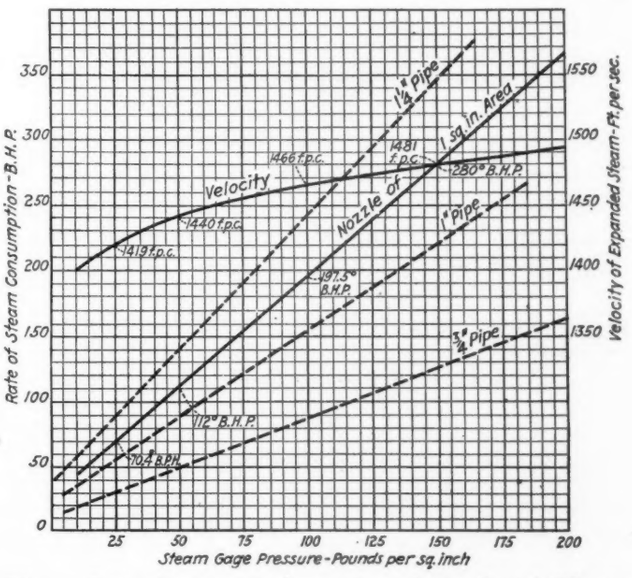


Fig. 1—Rate of steam discharge through nozzles of different size

* Part of a paper read at the annual Master Mechanics Staff Meeting of the C. M. & St. P. held at Milwaukee, Wis., on September 8, 1924.

and further, it quite frequently happens that no traps are provided on the high pressure radiators, in which case the steam is allowed to escape to the atmosphere unimpeded. A radiator full of steam when trapped will give off just as much heat as one where the steam is permitted to blow through to the air.

An illustration of what happens when steam is allowed to blow through a radiator into the atmosphere unobstructed is as follows: A pound of steam at 10 lb. gage pressure will give off 10 B.t.u. and a pound of steam at 125 lb. gage pressure will give off 42 B.t.u., whereas, if properly trapped and allowed to condense, a pound of steam at 10 lb. gage pressure will give up 980 B.t.u. and a pound of steam at 125 lb. gage pressure will give up 1,012 B.t.u. while as a matter of fact, the effect on the room temperature is the same in either case because the radiator will be no hotter in one case than the other, provided the condensation is drawn off properly. In other words, if steam is allowed to blow through the radiator unimpeded,

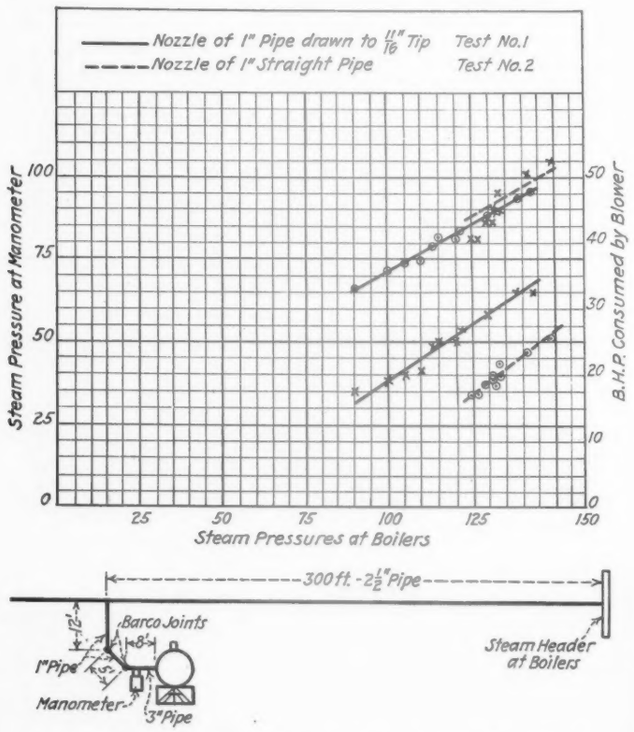

Nozzle of 1" Pipe drawn to 11/16" Tip Test No.1
Nozzle of 1" Straight Pipe Test No.2
Steam Pressure at Manometer
B.H.P. Consumed by Blower
Steam Pressures at Boilers
300 ft. - 2½" Pipe
Barco Joints
1" Pipe
Manometer
3" Pipe
Steam Header at Boilers

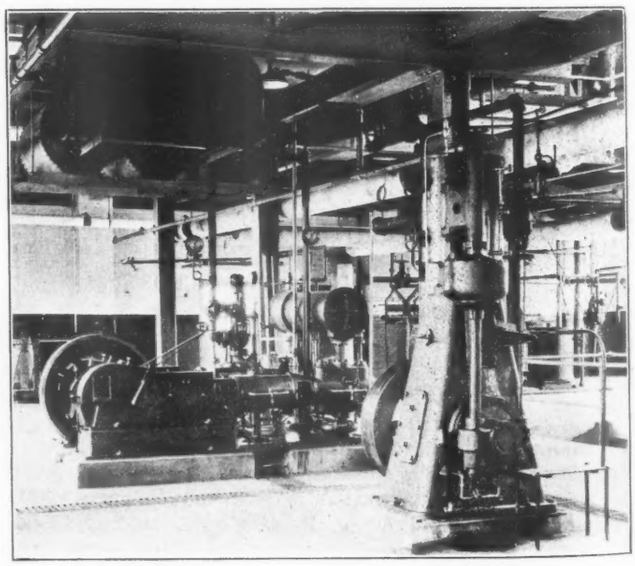
Fig. 2—Actual steam discharge through straight end drawn nozzle tips determined by tests at the Western avenue, Chicago, enginehouse of the C. M. & St. P.

it will require 92 times as much steam at 10 lb. gage pressure and 24 times as much steam at 125 lb. gage pressure to produce the same amount of heat as could be obtained with one pound of steam in either case if the radiators were properly trapped. In addition, there is still 180 B.t.u. in each pound of steam after it has condensed that may be recovered with a properly operated vacuum return system. Bearing in mind that at 10 lb. gage pressure there will be 275 lb. of steam per hour discharged through a ½-in. pipe which, on the basis of 6,000 B.t.u. equivalent per pound of coal, will approximate 50 lb. of coal per hour, it will be evident that this feature has an appreciable effect on the coal consumption.

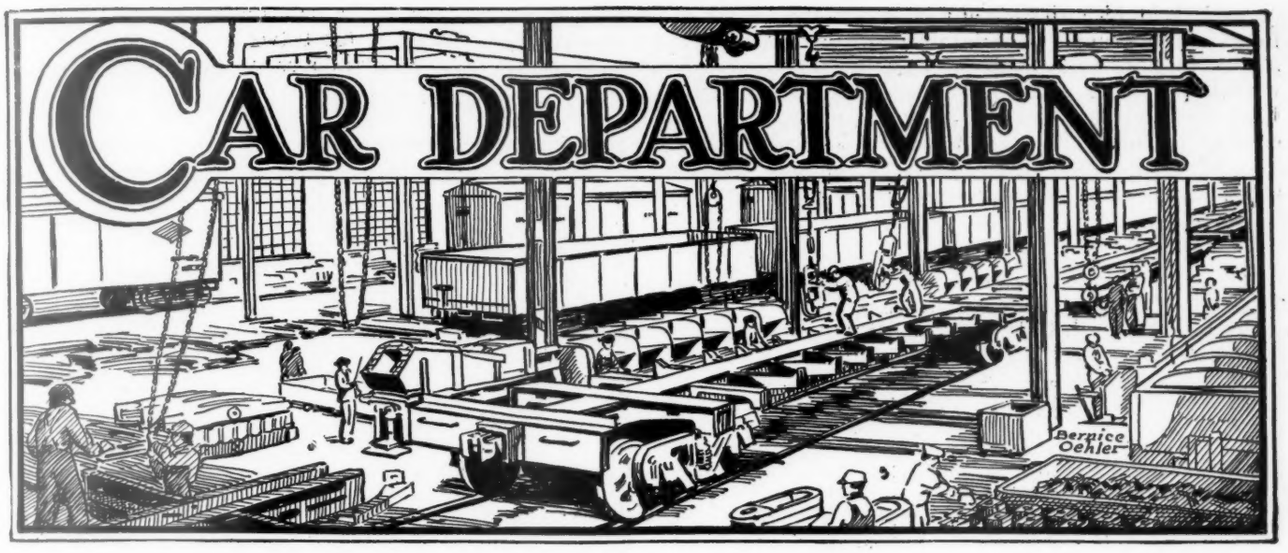
There are no doubt instances where the installation of a properly installed vacuum return system, which would include all the radiation, would give the same relief as the installation of an additional boiler in the power plant.

Another heavy steam consumer at engine terminals that is not always fully appreciated is the roundhouse blower line. The amount of steam that blows out through the locomotive stack while firing up an engine depends entirely upon the amount of steam that the blower pipe line can carry. Fortunately in most instances the distance from the boilers is so great and the blower pipe line is so small, particularly where it drops down to connect to the front end blower, that the steam pressure has dropped sufficiently to hold the steam consumption to a reasonably small amount. Fig. 1 shows the rate of discharge of steam into the atmosphere for varying steam pressures from pipes of different sizes. The heavy line indicates the amount of steam discharging through a nozzle of 1 sq. in. cross sectional area. The blower arrangement in the majority of the engines consists of a 1¼-in. pipe, which, if there were unrestricted volume back of it, would consume steam at 150 lb. gage pressure at the rate of 345 boiler hp. However, on account of the small pipe sizes used in the blower line and blower line drops, the actual consumption is very much less than 150 lb. of steam.

In order to determine just what this amounts to, some actual measurements were taken recently at Western avenue. The test results are shown graphically in Fig. 2. From these it is determined that with boiler gage pressures between 125 and 150 lb. the steam consumed is between 40 and 55 boiler hp. This will vary with the steam pressure and will be effected somewhat by the distance from the boiler room, owing to the pressure drop in the main pipe line. However, the greatest pressure drop occurs in the small pipe and connections between the blower line and the front blower connections, as this is usually reduced to a ¾-in. pipe connection. From this and other information collected on the subject, it may safely be assumed that the average consumption for blowers is no less than 50 hp. With the blower on for 45 min. this would represent about 225 lb. of coal (6 lb. per boiler-hp. hour).



An interior view of the steam laboratory at The Pennsylvania State College, showing a Kingsford-Stumpf vertical unaflow engine in the foreground and a Chicago pneumatic compound-steam, two-stage air compressor in the background.



Turtle-back roof applied to B. & A. suburban cars

Maximum seating capacity with convenient facilities for prompt loading and unloading—Vestibule ends economically constructed

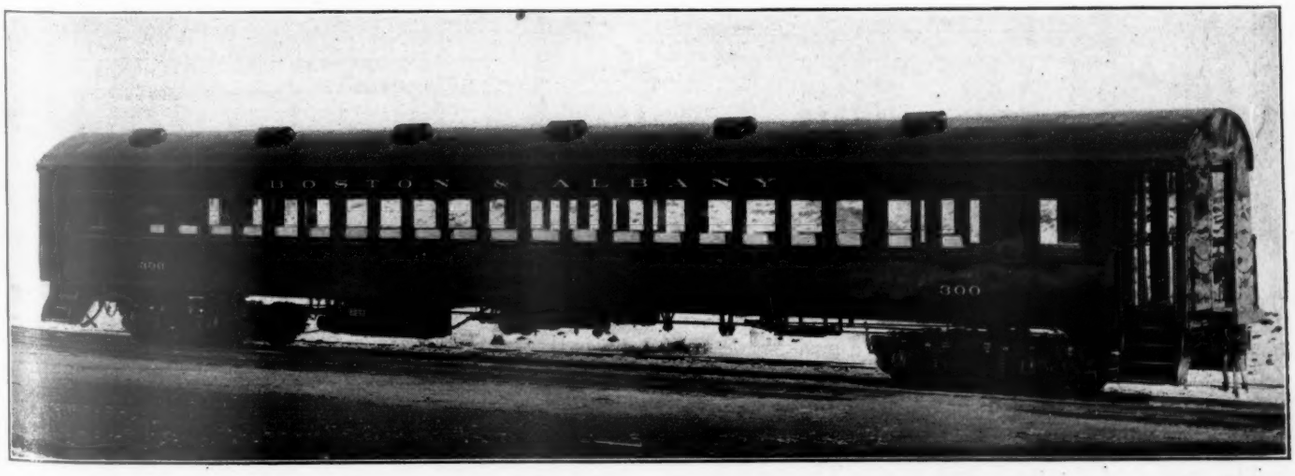
AN order of 50 steel suburban passenger coaches built by the Osgood Bradley Car Company, Worcester, Mass., has recently been placed in service by the Boston & Albany. The passenger cars now used on the main line and the highland branch between Boston, Mass., and Riverside, will be replaced by this equipment.

Before designing this equipment the problem of handling suburban passengers in and out of Boston was carefully studied, after which it was decided that the utmost seating capacity with convenient facilities for promptly loading and unloading were demanded by the conditions. Features of the cars which help to attain these ends are the ample space provided at each end of the car for standing room, the wide end doors and wide steps with four treads and the fact that the seats have no arms, which adds considerably to the ease of passage through the aisle and entrance into the seats.

Underframe frame construction equal to that of coaches in through passenger service

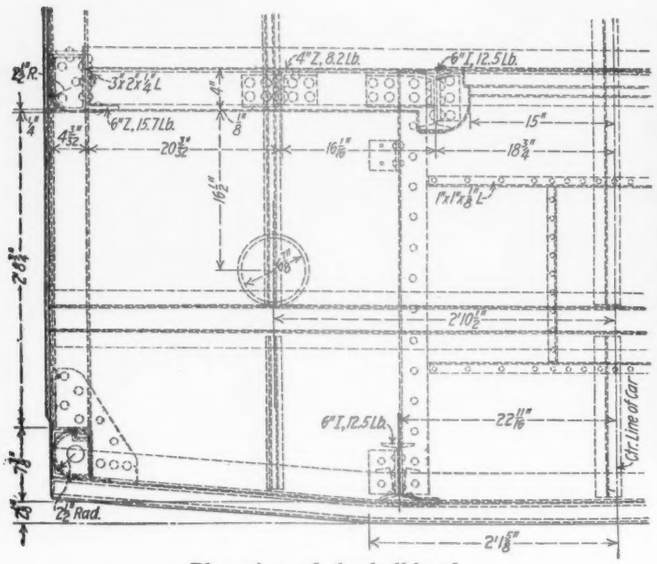
The cars are of steel construction throughout, with steel interior finish. The underframe and superstructure details have been so designed that their strength is equal to that of coaches in through passenger service.

The center sills consist of two 12-in., 35-lb. channels,



Steel suburban passenger coach with seating capacity for 100 passengers

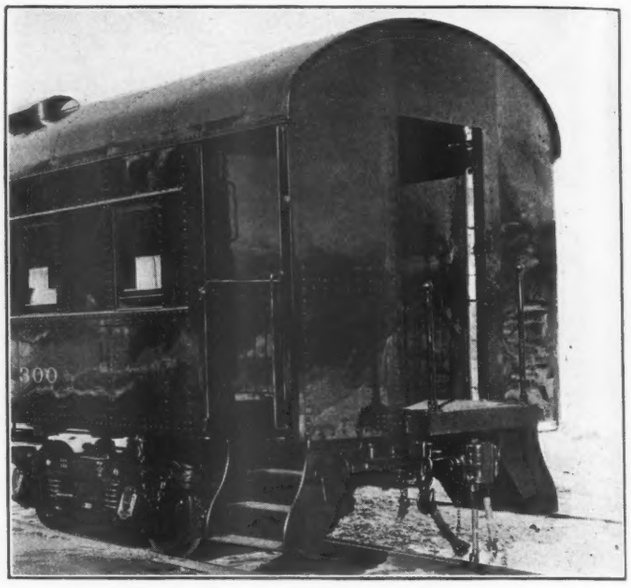
spaced 18 in. back to back and riveted to the bolster castings. Each channel is reinforced at the bottom by a 3½-in. by 3-in. by 7/16-in. steel angle. The cover plate is 28 in. by ¼ in. extending between the bolster centers. Cast steel body bolsters and platforms make up the two ends of the underframe construction. The side sills are 5-in. by 3½-in. by 7/16-in. rolled steel angles. The side and center sills are tied together with three ¼-in., pressed



Plan view of the bulkhead

steel, flanged, crossbearers provided with ¼-in. cover plates.

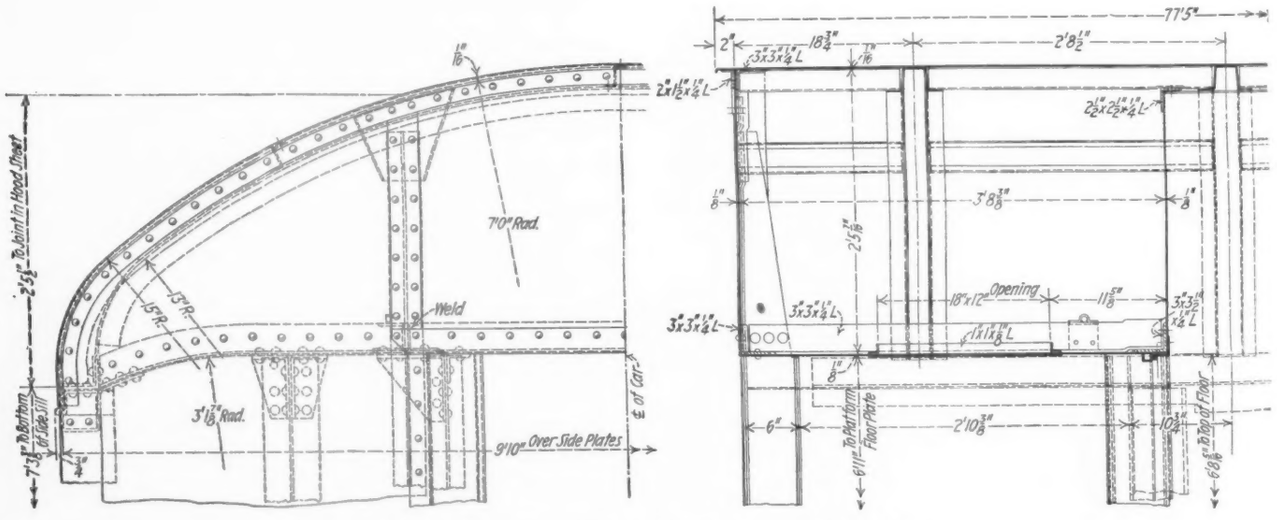
The 12 floor supports form additional underframe members and consist of ⅛-in. pressed steel channel shapes. Riveted to the pocket in the bolster casting at each end of



Turtle-back roof permits economical end construction of the car

together over the carlines and are made tight by welding. The cars have no hood as the roof sheets extend in a straight line to the intersection with the vestibule end sheets. One of the drawings shows a plan of the bulkhead constructed. The roof is provided with 12 Garland type ventilators, with registers in the interior.

Single windows are used in these cars with the sash



Longitudinal and cross section of the vestibule roof

the car, are two end door posts which consist of 6-in., 12½-lb. I-beams. At each end of the car riveted to the bolster casting are two intermediate end posts made from 4-in., 8.2-lb. Z-beams. The 6-in. Z-beam body corner posts are riveted to the bolster casting.

Turtle-back roof effects savings in materials

The roof is of the turtle-back type. The construction consists of 28 carlines of the flanged channel type made of 3/32-in. steel plate. There are three purlines of ⅛-in. pressed steel, Z shapes, fitted between the carlines. The roof sheets consist of 1/16-in. steel sheets, extending from the side plates in one piece. The roof sheets are butted

fitted with O. M. Edwards window fixtures. The seats are spaced so that each passenger is opposite a window. Over the seats are basket racks of the Adams & Westlake type which will provide ample space for commuters' parcels.

The cars are well insulated, having three-ply of ¾-in., special hair felt which covers the entire inside surface of the outside sheathing on the sides and ends of the car, except above the windows. The flooring is composed of

special 5/8-in. corrugated galvanized steel, laid crosswise of the car and covered with Flexolith. The platform floor is covered with Feralun.

Low-arched, light colored ceiling diffuses light

To facilitate reading, the lighting arrangement of these cars has been carefully planned. Along each side of the

The coaches have seating accommodations for 100 passengers —Ratan seats without arm rests

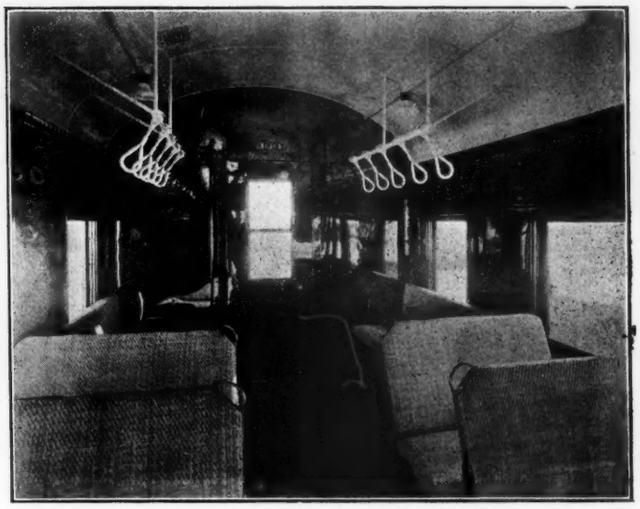
low-arched ceiling are placed 26 attractive lamps. The head lining is finished in a cream color down to the frieze moulding. This combination of a low-arched, light colored ceiling, diffuses the light so that the passengers can read comfortably. Current for the lamps is furnished by Gould electric light equipment, and each car is provided with a 225-ampere Edison battery. The steam heating system is of the Vapor type, designed to maintain at all times a comfortable temperature on the interior. The cars are equipped with the New York U. C. air brake equipment.

Four-wheel trucks are used, equipped with the Simplex clasp brakes, and 33-in. forged steel wheels. The small wheels are used to facilitate charging the storage batteries, by their greater number of revolutions. The journals are 5 in. by 9 in.

It will be noticed that the end doors have an opening of 2 ft. 6 in. and that considerable room has been provided immediately inside of the doors. The platforms have an opening of 2 ft. 9 in. at the vestibule steps. A standing space of approximately 14 sq. ft. is available. The vestibule steps have four treads and are easy to reach from the platforms at track level.

Weight per seated passenger slightly over 1,000 lb.

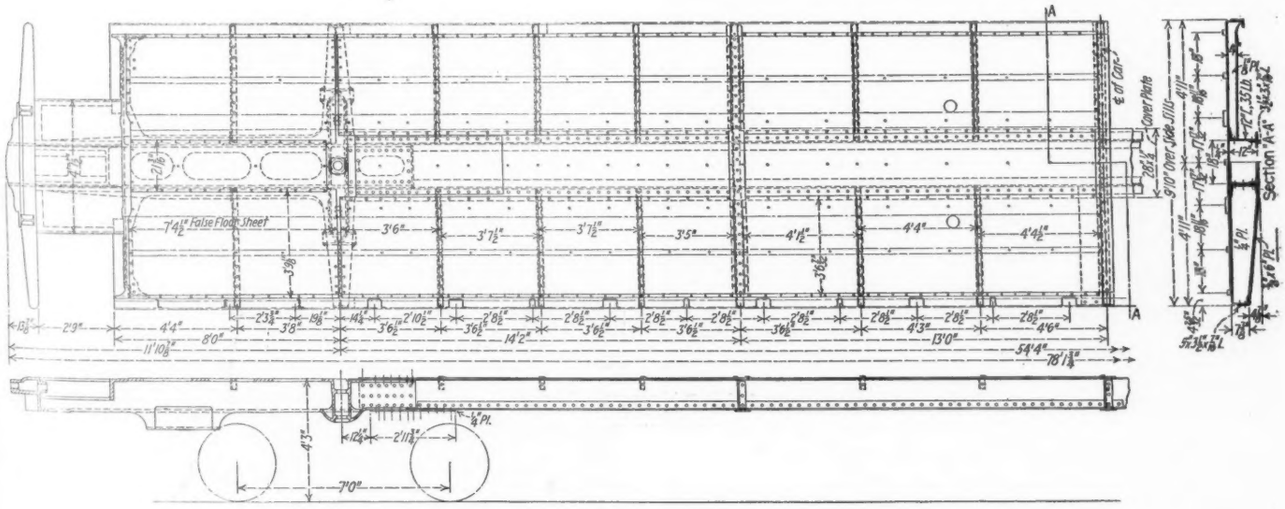
The empty weight of these cars is 101,500 lb. With a seating capacity of 100 persons the weight per seated passenger is but slightly over 1,000 lb. The over-all length of the cars coupled is 78 ft. 11¾ in.



Ample standing room and overhead hand straps are provided at the ends of the cars

A WAGE INCREASE of two cents an hour has been granted by the Atchison, Topeka & Santa Fe to its shop crafts employees on all lines.

Enginemen and firemen on the Southern Pacific lines in Texas and Louisiana have been granted a wage increase of approximately 5 per cent, retroactive to September 21, 1924. This increase is in line with similar ones which were awarded previously on the Southern Pacific, Pacific system, and on other western roads.



Underframe construction of the Boston & Albany suburban cars

D. L. & W. Hoboken, N. J. terminal, which handles from 66,000 to 67,000 commuters daily

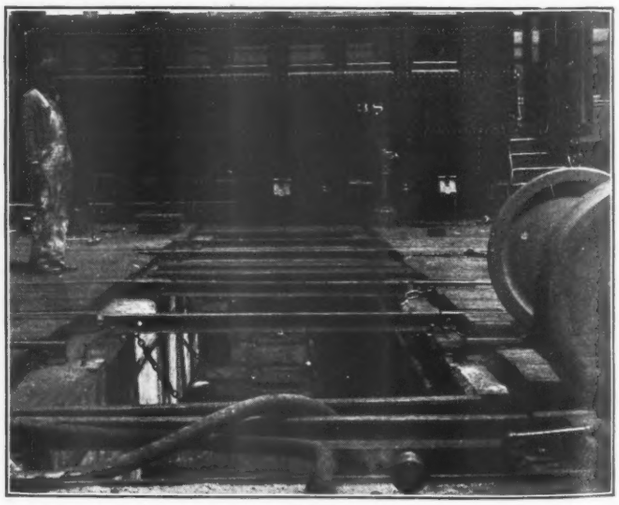
D. L. & W. coach maintenance at Hoboken, N. J.

Adequate facilities and organization have increased the time between shoppings—Paints emulsion cleaned every five months

THE terminal maintenance of passenger equipment is one of the big problems of the car department. Just as it is important to provide adequate facilities and efficient organizations for the proper maintenance of locomotives at terminals, so is it essential to provide the proper facilities and organization for the terminal maintenance of passenger equipment. The principal object of this plan is to increase the length of time between the shopping of cars and, in doing so, keep the number of cars going in the repair shops down to a minimum. In other words, the rate of depreciation of passenger equipment is decreased with the increased efficiency of terminal maintenance.

Blacksmith forge located near repair tracks

The maintenance of passenger car equipment at the Hoboken, N. J., terminal of the Delaware, Lackawanna & Western is based on the above principles. Proper facilities and organization are necessary to handle the cars at this terminal, as 115 suburban trains and 10 main line trains are dispatched every 24 hours. Approximately 450 suburban cars make 700 arrivals and 150 main line cars enter Hoboken every day which gives a total of about 850 car arrivals. Between 66,000 and 67,000 commuters pass through the Hoboken terminal every day.

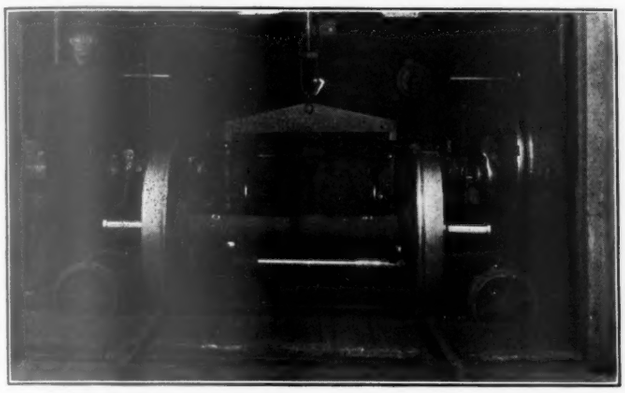


Four track drop-pit located 60 ft. from the wheel lathe

The train and car arrivals have been carefully analyzed by means of graphic charts which show the number of cars arriving and leaving each hour of the day. This graph indicates the rush periods and serves to act as a guide for putting on the maximum working force and the best time of the day to take the cars out of service for repairs.

Method of cleaning cars

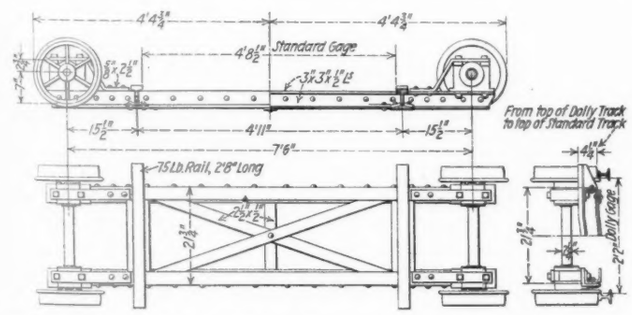
A schedule has been worked up by which the cars are cleaned on an average of once every five months by an emulsion cleaner. The controlling factors used in preparing this schedule are the condition of the cars, the service they are in and the time out of the shop. The length



Pair of wheels on the dolly truck ready to be placed on the outbound track

of the period between general repairs depends largely on the condition of the paint on the car.

To retain the lustre and preserve the paint, the cars are passed through a coach cleaning shop which has two pit tracks with a capacity of six cars. The cars are taken from service after the morning rush hours, passed through the shop and put back in service in time to handle the evening peak traffic. There are six men in this shop who work on a piece-work basis. The exterior of the cars are



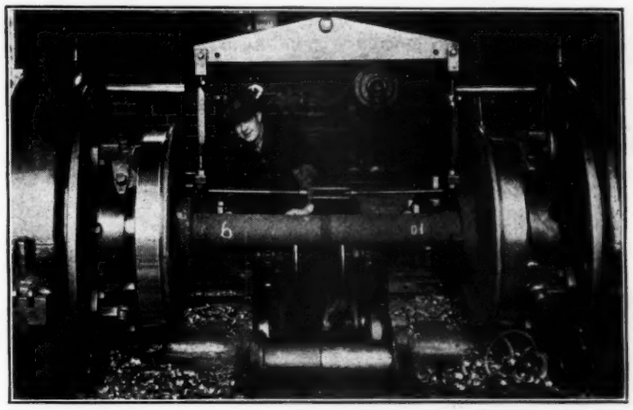
Dolly truck which facilitates the movement of wheels to and from the wheel lathe

cleaned with an emulsion cleaner which removes all of the dirt and grime from the paint and gives it a finished appearance. If the interiors of the cars need cleaning, the paints are washed or renovated which returns the paint to its original lustre. Of course, the floors and lavatories are thoroughly scrubbed and cleaned. Cars on the through trains are either emulsion cleaned, washed or repainted, depending on the condition of the paint. Between the working hours of from 8 A. M. to 4 P. M. five cars are passed through this shop without being withdrawn from service. This operation is also carried on in the winter as a temperature of 70 deg. is maintained in the shop.

Facilities are provided at one end of the coach cleaning shop for the mounting of air, signal and steam hose. During the day a workman from the shop does this work. After the evening rush hours, the terminal car inspectors do this work, as they have plenty of time on their hands between the departure of the evening trains.

Maintenance of car trucks and platforms

All the truck and platform work is done at this point, between the morning and evening rush hour periods without the need of taking the cars out of service. A gang of 12 men is assigned to do the work. A four-track drop pit, which is shown in one of the illustrations, has been provided to facilitate the dropping of wheels. The drop pit is made of concrete and is about 4 ft. deep and 5 ft. wide with a 2-ft. 2-in. dolly truck at the bottom passing under the four tracks. The car truck containing the pair of wheels to be removed is placed over one of the pits. When the wheels are ready to be removed, a small four wheel dolly truck is placed over one of the pneumatic pit jacks and raised up to the wheels. The wheels are raised off the track and the two rail sections are removed which allows the wheels to be lowered into the pit. The truck and wheels are then run along the bottom of the pit to the track which leads to the wheel lathe. The rail sections



Pair of steel wheels can be machined on this lathe and placed on the outbound track in 25 min.

over this track are removed and the wheels raised above the track level and then the rail sections replaced. The wheels are then lowered and rolled out on the wheel lathe feeder track. This arrangement provides a quick method of removing and replacing wheels.

A short distance from the drop pits is a blacksmith forge which is completely tooled to handle any kind of repairs which may require a blacksmith. A skilled blacksmith is assigned to this work but since he does not have enough work to keep him busy throughout the day, he helps the general repair gang.

Method of handling wheels

The decision to install a wheel lathe at Hoboken terminal was primarily based on economic considerations. Prior to the installation of the wheel lathe all wheels to be turned had to be transferred to Kingsland, N. J., which is about 7 miles from Hoboken. This operation tied up a considerable amount of wheels and kept cars out of service longer than was necessary, besides the expense involved in moving the wheels between these points. It was figured that the expense involved in transferring the wheels to the distant point plus the capital tied up in extra wheels,

kept on hand for repair work, would pay for a wheel lathe in a comparatively short time. In other words, it was more economical to bring the tool to the work instead of the work to the tool.

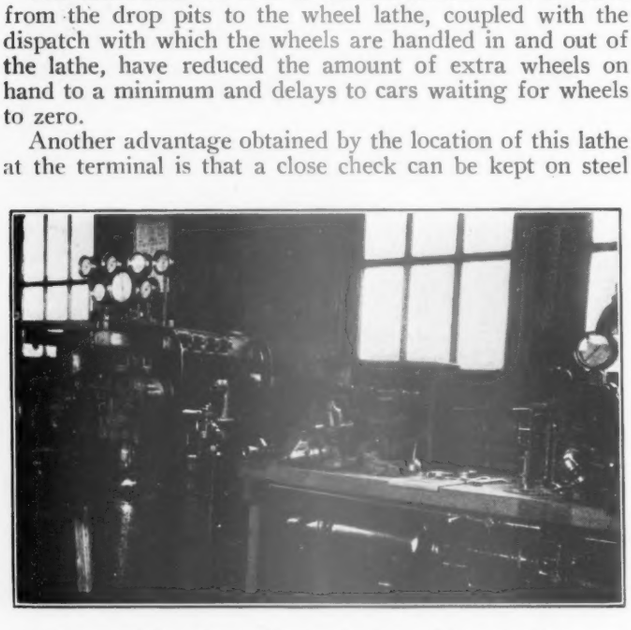
As a result a Sellers wheel lathe, capable of turning steel wheels, was installed. This lathe is housed under a shed which is approximately 60 ft. from the center line of the drop pits. There are two tracks leading to the wheel lathe, one for wheels waiting to be turned and one for turned wheels. These tracks each hold about 15 pairs of wheels. Just at the end of these two tracks and directly in front of the wheel lathe, is a 2-ft. 2-in. dolly truck, which is shown in the accompanying drawing. The distance between the axle centers in 7 ft. 6 in., in between which are fastened two sections of 75-lb. rail, 2 ft. 8 in. long and located 15½ in. from the center of each axle, which makes the distance between the rails 4 ft. 8½ in.

The lathe is placed on a concrete foundation sufficiently below the ground level so that a pair of wheels can be rolled to the lathe and readily placed on its centers by means of an overhead air hoist. After the wheels are turned, they are placed on the dolly truck and moved to the outbound track. By means of this arrangement a pair of wheels can be rolled into the building, placed in the lathe, turned, removed from the lathe and rolled out on the finished wheel track in 25 min.

If a pair of Pullman wheels is needed in a hurry, a reverse movement can be made. The wheels can be run down the outbound track to the wheel lathe, thus avoiding moving all the wheels on the feeder track.

The short distance over which the wheels have to move from the drop pits to the wheel lathe, coupled with the dispatch with which the wheels are handled in and out of the lathe, have reduced the amount of extra wheels on hand to a minimum and delays to cars waiting for wheels to zero.

Another advantage obtained by the location of this lathe at the terminal is that a close check can be kept on steel

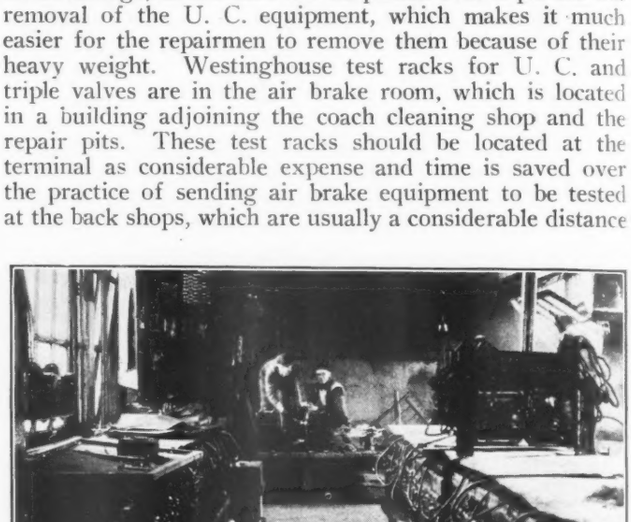


U. C. and triple valve testing racks located in air brake room

wheels in order to have them turned in time for use in freight service. In the past 36-in. steel wheels worn below the 1-in. limiting mark were scrapped. The A.R.A. rules now permit the use of these wheels in freight service, as there still remains ¼ in. of wearing metal which will give from three to four years of freight service. Full advantage is being taken of this ruling of the A.R.A. at Hoboken with the result that many steel wheels are being diverted to freight service.

Maintenance of air brake equipment and steam heat

The majority of the passenger car equipment at this terminal is of steel construction and equipped with the U. C. brake equipment. The schedule for bringing the cars in for cleaning has been so arranged that the U. C. equipment is due for cleaning at the same time. This is an advantage, as the cars can be placed over a pit for the removal of the U. C. equipment, which makes it much easier for the repairmen to remove them because of their heavy weight. Westinghouse test racks for U. C. and triple valves are in the air brake room, which is located in a building adjoining the coach cleaning shop and the repair pits. These test racks should be located at the terminal as considerable expense and time is saved over the practice of sending air brake equipment to be tested at the back shops, which are usually a considerable distance



Batteries from all the cars running into Hoboken are repaired in this shop

from the terminal. Furthermore, this arrangement keeps the air brake equipment down to a minimum. All air brake governors, reducing and steam heat valves are repaired in the air brake room.

Battery and car lighting maintenance

The batteries of all the cars running into Hoboken terminal are repaired in the battery repair shop, which is 14 ft. wide and 35 ft. long, and located directly beneath the air brake room. Six men are assigned to battery maintenance, four in the repair shop and two outside inspecting and making minor repairs. The batteries are removed from all the cars sent to the shops for general repairs and repaired and replaced when the cars come from the shop. A battery is removed from a car, torn down, rebuilt, tested and replaced in the car in 33 hr. time, which is considered a good repair figure. From 100 to 125 batteries are given a general overhauling in one year.

A gang of seven men is assigned to car lighting maintenance. They inspect and make minor repairs on the generators and the general lighting system. This force has become thoroughly familiar with the car lighting equipment and is able to locate and remedy trouble in a short time. Repair parts are kept at a minimum. Uniform results are obtained as routine inspection periods are made covering the whole equipment.

Method of cleaning cars in the yard

Considering that there are about 850 car arrivals every day at this terminal, considerable work must be done in the yards and in the train shed. One of the big jobs is the dry wiping of these cars every day. The work is done by gangs in charge of a gang leader. The arrival and departure of the trains have been analyzed so that these gangs can move from one train to the other with a minimum loss of time, the heaviest work being done during the longest layover. This arrangement is essential as all the cars must be wiped once a day, most of which is done on a piece-work basis. The cars are wiped with waste

which was used in the coach cleaning shop for the final polishing of the cars. This leaves a certain amount of the emulsion cleaner on the waste which helps to remove the dirt and polish the cars. The exterior of the cars are dry wiped, except in rainy weather, when they are washed.

Every suburban car is swept, dusted and mopped and the water cooler iced and filled daily. The water coolers are also steamed weekly. Repairs are made to all the hardware and other minor defects which can be quickly repaired.

The plush seats of the suburban cars are vacuum cleaned once a week and the main line cars once a day. This is accomplished by means of a vacuum system which is piped throughout the terminal and in all the offices. Two-inch pipe is used, from which an outlet is taken every 75 ft. The vacuum for this system is maintained by two vacuum pumps each driven by a 40-hp. Westinghouse induction motor. A vacuum of 21 in. is maintained at the plant with one vacuum pump. All the offices at the terminal are cleaned with vacuum cleaners.

Results obtained at Hoboken

The facilities and the organization described in this article were planned to achieve certain definite results. The primary object was to increase the length of time between shopping periods of passenger equipment, without deterioration to the cars and without sacrifice of a favorable general appearance of the equipment. In doing this the number of cars passing through the general repair shop every month would be reduced and thus the working force eventually reduced. The length of time out of the shop for D., L. & W. passenger cars has been increased from 12 to 18 months or over. Thus, if a shop had to give general repairs to 1,200 cars, it would have to handle 100 cars a month on a 12-months shopping basis and on an 18-months shopping basis would have to handle 66 cars a month. The saving effected is obvious.

The results of receiving periodical emulsion cleaning give a more general uniform appearance of trains which reacts favorably to the traveling public.

Decisions of the Arbitration Committee

(*The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.*)

Work necessary to justify the charge for cleaning air brakes

On February 27, 1923, the Charleston & Western Carolina cleaned the air brakes on N.O.T. & M. car No. 750 for which it rendered to the Gulf Coast Lines a bill for $5.17. The Gulf Coast refused to pay the bill on the grounds that the work had not been performed according to Rule 60 effective January 1, 1923, the second paragraph of which provides that the charge is not permissable for cleaning the triple valve unless the triple valve cylinder, retaining valve, dirt collector or pipe strainer are all cleaned at the same time. The items listed on the repair card indicated that the dust collector or pipe strainer had not been cleaned. The Charleston & Western Carolina stated that car No. 750 was not equipped with a dirt collector but was equipped with a strainer made solid in the train line tee at the branch pipe connections. It could not be cleaned or become dirty, as dirt or scale would go straight through the strainer and the train line and could not get into the branch pipe. The repairing line also contended that circular D.V. 276 was issued to cover this particular feature.

The Arbitration Committee rendered the following decision: "The charge in question is sustained, in accordance with Circular D.V. 276, dated April 28, 1923. At the date of the repairs, there was no requirement that the billing repair card should show that the car was not equipped with a centrifugal dirt collector."—*Case No.* 1325, *Gulf Coast Lines vs. Charleston & Western Carolina.*

Car damaged through lack of rider protection

The C. B. & Q. furnished a joint inspection statement, dated July 14, 1923, which contained a list of defects existing on C. & W. C. car No. 3074, and requested disposition under A. R. A. Rule 120. The handling line did not advise the circumstances under which the damage occurred. Later, the C. B. & Q. advised that the C. & W. C. car was damaged in switching service without rider protection. As a result of this admission on the part of the handling line, the car owner declined to authorize repairs, as the damage was the handling line's responsibility under Rules 143 and 120 and Rule 32 Section D, Item 4. The handling line contended that ample evidence had been furnished the car owner that its car had been damaged in fair usage on a practically level track where no rider protection was necessary. The car owner contended that even though the switching took place in practically a level yard, the fact that the impact of two cars coming together broke six sills on its car, indicated that rider protection should have been provided.

The Arbitration Committee rendered the following decision, "The handling line is responsible for the damage to this car as per Rule 32, Section (d), Item 4. Case 1224 is parallel."—*Case No.* 1331, *Chicago, Burlington & Quincy vs. Charleston & Western Carolina.*

Charge for testing and adjusting safety valves on tank cars

During the months of October and November, 1923, the Shaffer Oil & Refining Company tested the safety valves of 17 cars belonging to the Johnson Oil Refining Company. Each car was equipped with two safety valves. Bills were rendered against the car owner for this work with a labor charge of four hours per car, two hours for adjusting the valves to a 20-lb. pressure and two hours for the testing. The labor charges were assessed according to A. R. A. Rule 107, Items 288 and 288B. The car owner returned the bills to the repairing company for correction stating that only two hours labor should have been charged for each car in accordance with A. R. A. Rule 107, Item 288B. The car owner stated further that the testing and adjusting should be considered as one operation as safety valves must be tested after being adjusted to show that they have been adjusted correctly. The repairing line contended that the two operations were separate, inasmuch as the valves were removed from the car and put on a test rack. If the spring is properly adjusted to 25 lb. pressure, the valve is considered O.K. If not properly adjusted, the valve has to be removed and the spring adjusted until it releases at 25 lb. This makes it necessary to take the valve off and on several times to make the proper adjustment.

The Arbitration Committee rendered the following decision: "The contention of the Shaffer Oil & Refining Company is sustained."—*Case No.* 1328, *Johnson Oil & Refining Company vs. Shaffer Oil & Refining Company.*

One day's output—Eight completed cars

Burlington rebuilds eight box cars a day at Aurora

Successful application of station-to-station method and production system has resulted in increased output

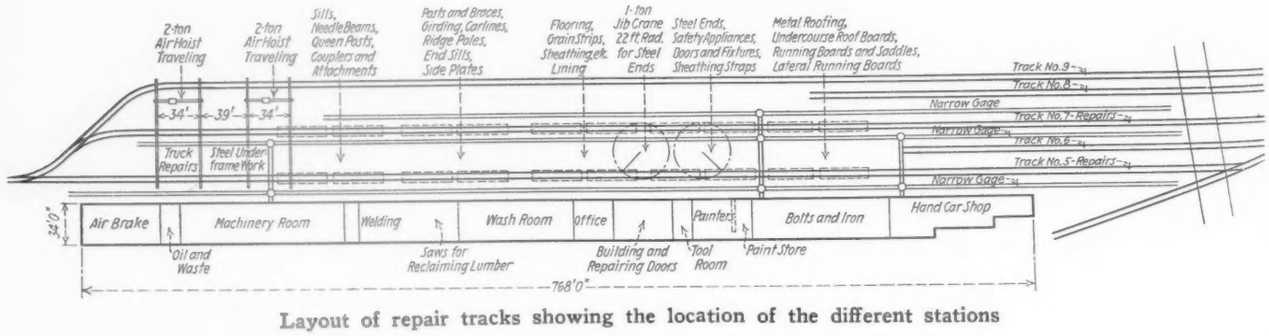
AT the Aurora, Ill., car repair shops of the Chicago, Burlington & Quincy an extensive application of the station-to-station method has been in operation for several months which has two features of unusual interest: First, the fact that the station-to-station method has been successfully applied to a rebuilding operation where the cars are not completely dismantled and, second, a simple production system which not only increases the earnings of the men engaged but serves as well to speed up production. Work on this program was started on November 25, 1924, and, up to April 2, 1925, with two rebuilding tracks working, 681 cars had been completed.

The cars being rebuilt are 40-ft., 80,000-lb. capacity box cars with wood superstructure, side and intermediate sills and steel center sills. In the rebuilding operation they are fitted with two-piece corrugated steel ends and metal roofs.

The present rebuilding operation is carried on on two parallel tracks with identical work being performed at adjacent locations as the cars are moved from station to station. The output averages four cars per track for each working day, a total of eight finished cars per day. By this method a car is completed and ready for service at the end of the fourth day from the time it is placed on the stripping tracks.

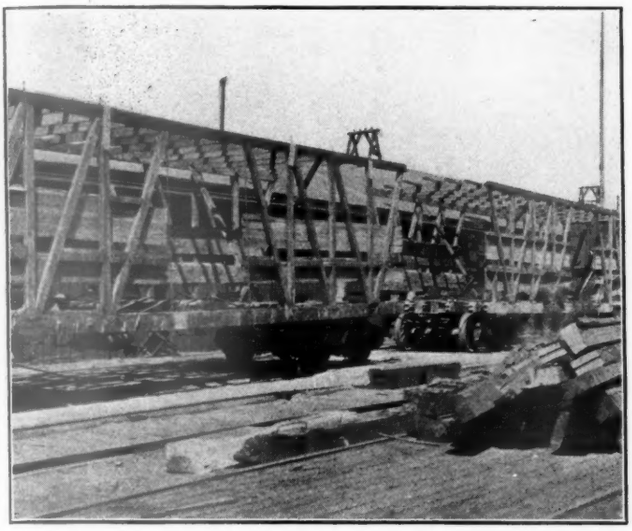
At the present time the average force employed on the entire stripping and rebuilding operation consists of 146 men classified as follows:

25 helpers and laborers on stripping tracks.
82 freight car repairers on the two rebuilding tracks.
1 steel car repair man } On truck channels.
1 steel car helper }
13 steel car repairmen } On repairs to steel center sills.
6 steel car helpers }
2 steel car repairmen } On fabrication of steel ends.
4 steel car helpers }
3 air brake repairmen.
5 painters.
3 door men.
1 car oiler.



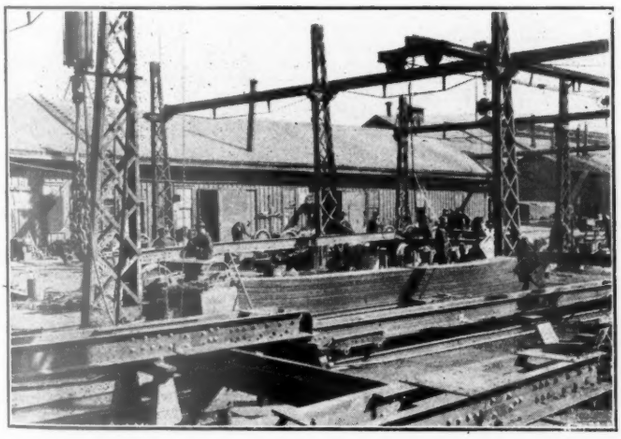
Layout of repair tracks showing the location of the different stations

Before putting this repair system into operation a careful study was made of the various operations and the time required for each and a schedule was prepared providing a fixed time allowance for each operation. The total time allowance for all operations required in complete stripping



Stripping operation completed—Ready for rebuilding

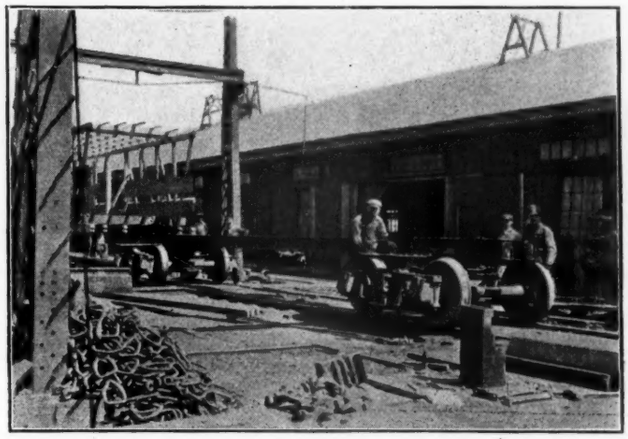
and rebuilding program is 203½ man-hours per car. At the present time the work has progressed and been systematized to such an extent that the average time per car has been reduced to approximately 144 man-hours. A production system is in effect whereby if a gang is able to complete their particular operation in less than the time allowed by the schedule it results in a proportionate in-



Truck and steel center sill repair station showing overhead cranes

crease in the amount paid them for that particular operation. This system is remarkably simple and efficient in operation. The fact that it is possible for one man to keep all of the time records of the total force employed in connection with the complete rebuilding operation is an indication of the simplicity of the time and production system. The production feature functions in such a manner that if a gang on a certain operation is able to complete that operation on a number of cars within a given period in less time than the schedule allows, they are paid at the rate of the allowed time per car for the actual number of cars completed. For example: Suppose on a certain operation two men were allowed 1 hr. 30 min. per car and their hourly rate was 62 cents. They are actually able to complete their operation on 12 cars in 13½ hrs. However, they would be paid for 12 cars at the allowed time of 1 hr. 30 min. each, or a total of 18 hrs. at the hourly rate of 62 cents. In this manner their hourly rate for 13½ hours would be actually increased to 82.6 cents.

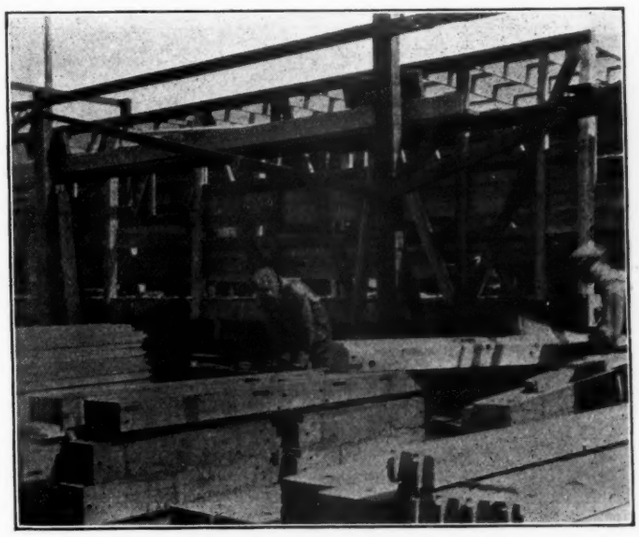
The fact that the rebuilding operations are conducted on parallel tracks sets up a spirit of friendly rivalry between adjacent gangs at the different stations and this has enabled a substantial reduction in the time required



Trucks and sills repaired and ready to be returned to car

to complete the rebuilding of a car as well as a general increase in the earnings of the men.

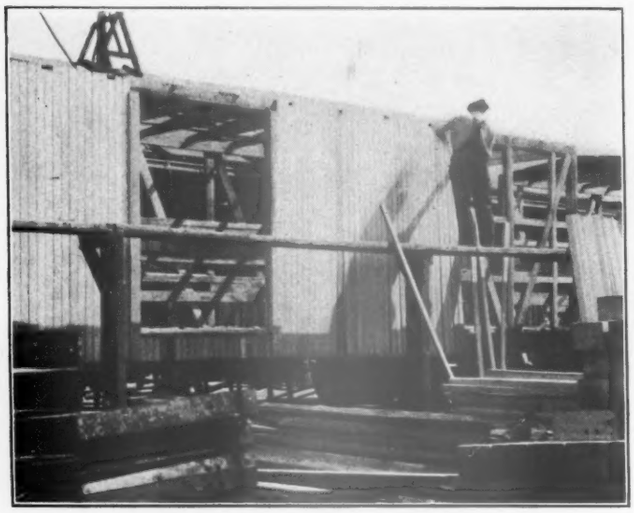
In general, a given number of cars to be rebuilt are placed on the stripping tracks each morning. After the stripping operations are completed the cars are moved by tractors and placed two at a time on each of the two rebuilding tracks. The first rebuilding operations consist principally of the jacking up of the car body and the



The framing of the car completed

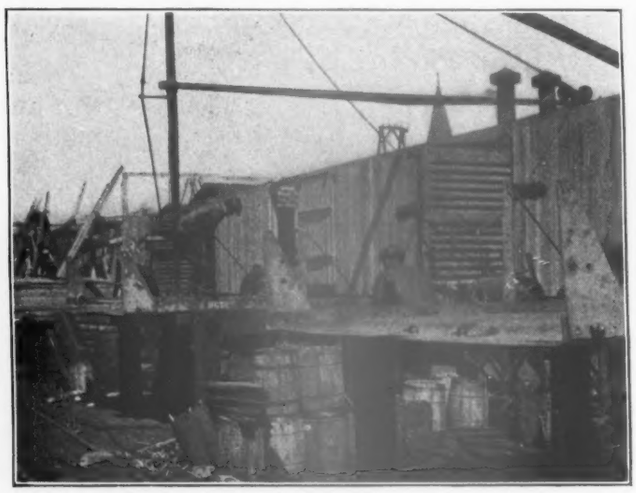
removal of the trucks and steel center sills for repairs and the application of cover plates. An interesting feature of this operation is the manner of removal of the trucks and center sills from two cars at a time. Both cars on one track are jacked up and after the trucks and center sills

are run out from under the car nearest the truck repair station the trucks and sills from the second car are removed from under the car and follow the first set, passing under the first car on the way to the truck repair station. Overhead crane service is provided at the truck and steel center sill repair station and the air brake repair and test room is located adjacent to this station. When the work at this station is completed the car is moved to the next station where the work on the body framing, flooring and sheathing, etc., is carried on. Adjacent to this station is the door shop where three men turn out an average of 16 complete side doors and 16 running board



Framing completed—Applying the side sheathing

extensions each eight-hour day. The fabrication and application of steel ends is also made at this location. From here the cars are next moved to the stations where all roof work is completed and from there to the stations where the first and second coats of paint are applied and finally all stencilling is done and final inspection made.



Fabricating the steel ends

Rigid inspection is also made at the completion of each operation.

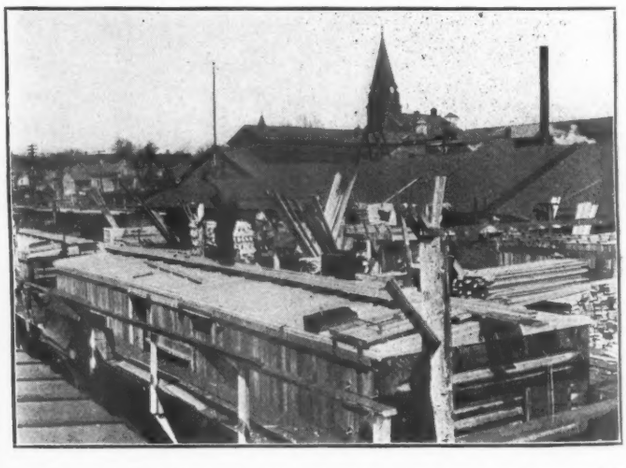
The general layout of repair facilities makes it possible to effect an unusually economical scheme of material distribution. Material for the various operations is concentrated at each station, a separate gang checking material at all times and providing material from the main storehouse, car machine shop, blacksmith shop, and mill to replace that which is used. Tractors with trailers and trucks on narrow gage tracks are used to transport this material.

Details of operations at each station

Position No. 1—*Stripping*—Operations: Remove running boards and roof, brake shaft castings, all fascia, side and end doors, door

Car body completed ready for moving into position where roof is applied

tracks and fillers, door brackets, front and back stops, corner plates, grab irons, sill steps, sheathing and sheathing straps, corner end and side door posts, end plates, tie rods and buffer lugs, door lintel strips, nailing strips, necessary flooring, lining, grain strip and girth, threshold plates, cleaning nails from all framing not removed and the preparation and bracing of car for moving.



Roof repair position—Note elevated platforms and material

Remove box and column bolt nuts, end sills, buffer blocks, couplers, pin lifters, brake step, turnbuckles, truss rods, needle beams, body bolsters, all brake connections, pipe clamps, release rods; drive up post rods when side sills are to be removed and apply the necessary cleating of posts and braces.

Position No. 2—Rebuilding—Operations: Jack up car and remove trucks and steel center sills. Remove and replace side sills, intermediate sills or splices. Remove and replace truss rods, bolt truss rod saddles to sills, frame old needle beams, remove and replace lever carriers, floating levers and brake rods, air cylinder, needle beams and castings; replace trucks and steel center sills and body bolsters and jack car body down.

Position No. 3—Rebuilding—Operations: Tear down trucks and rebuild complete, including channels, bolsters, arch bars, springs, journal boxes, brasses and wedges, wheels, brake beams, brackets, hangers and pins, levers, bottom rods, brake shoes and

keys and dust guards. Men at this position assist in removing trucks and steel center sills from under the car and help take combined steel sills off the trucks, apply couplers, followers, springs, friction castings and tie castings. They also assist in replacing trucks and steel center sills under the car. Spring chan-

Painting finished and ready for stenciling

nels are also repaired at this position by a separate gang of two men.

Position No. 4—*Rebuilding*—Operations: Straighten steel sills; apply cover, lap and gusset plates, body bolster and truck center plates, needle beam clips; line up broken sills and apply channel patches. Remove and replace draft castings and body bolsters. Cut up scrap sills, and do all necessary burning, bolting up, reaming, heating and driving rivets. The men assist in handling steel sills off and on trucks.

Position No. 5—*Rebuilding*—Operations: Apply end sills, corner posts and lugs, side door posts, intermediate posts and side braces, end and side plates and rods, carlines and anchor lugs, purlines and ridge pole, renail old purlines, tighten carline lugs, sill steps, sheathing girth, ladder posts, anchor rods for steel ends, carline and ridge pole bolts.

Position No. 6—*Rebuilding*—Operations: Apply and nail side sheathing complete. Apply and nail flooring, complete.

Position No. 7—*Rebuilding*—Operations: Apply side doors, side door stops, open door stops and blocks, door brackets, tracks and fillers, door hasps on stops and doors, side plate door headers, grab irons, brake step, sheathing straps, side plate anchor rods, uncoupling levers. Bore holes. Adjacent to this position is the door shop in which three men are employed on side doors and running-board extensions.

Position No. 8—*Rebuilding*—Operations: Rivet metal ends together including the application of gusset plates. Apply metal ends. Bore holes and apply bolts through middle and bottom gusset plates; intermediate tie rods, apply truss rod nuts, turnbuckles and block and tighten up. Apply buffer blocks, carry irons and end sign boards.

Position No. 9—*Rebuilding*—Operations: Apply side and end lining. Bolt nailing strips to steel ends, post strips, grain strips, lining blocks, clean nails off inside the car and apply threshold plates.

Position No. 10—*Rebuilding*—Operations: Apply metal roof complete including all filler battens, longitudinal running board, running board extensions, brake shaft and bracket, saddles and brackets, side and end fascia. Apply all washers, lock nuts and nuts on all roof bolts inside the car, lay bottom course diagonally, set nails, end plate tie rods: straighten car, bore holes and apply bolts in top gusset plates and end plates.

After all rebuilding operations are completed the cars are given two coats of paint by the spray method and all stenciling is done. When this is completed final inspection is made and the cars are ready for service.

Hand brake power for freight cars

A discussion of the recommendations contained in the report of the A. R. A. Committee on Brakes and Brake Equipment

By Robert H. Blackall

THE recommendations contained in the report of the Committee on Brakes and Brake Equipment of the American Railway Association, Mechanical Division, which was made at the convention held at Atlantic City, N. J., June 11 to 18, 1924, were ordered submitted to letter ballot of the members. The letter ballot circular, No. D. V.-375, was mailed at Chicago, October 18, 1924, and the ballot was closed on November 18, 1924. It was recommended by the committee that the hand brake wheel or hand brake ratchet lever, brake staff at the chain, and the hand brake leverage between the brake staff and cylinder shall be so proportioned that a force of 125 lb. at the rim of the brake wheel of three inches from the outer end of the hand brake ratchet lever develop an equivalent load W at the brake cylinder piston of not less than 2,500 lb. and 3,950 lb., respectively, for cars having 8-in. and 10-in. cylinders. Inasmuch as the views of the writer, which are based upon practical tests with the dynamometer, do not coincide with the results assumed in the report, a discussion of some of these results and various points connected with the subject in general may be of interest.

According to the formulas given in the report, the pull on the chain at the brake shaft would be $W = \frac{125L}{r}$ in which $r = M + K$. M is the radius in inches of the brake staff drums, and K, the distance, in inches, from the face of the brake staff drum to the center line of the brake chain.

The instructions in the report, using a 7/16-in. brake chain as shown in Fig. 1, give $K = \frac{1}{2}$ in. Using the brake shaft drum shown in Fig. 2, $r = 1\frac{1}{4}$ in., $L =$ the diameter of the brake wheel, or the distance from the center of the shaft to the end of the ratchet lever, and $W =$ the work performed.

Referring to Figs. 2, 3, 4 and 5, it will be seen that the distance from the center of the shaft to the center of the chain is $1\frac{1}{4}$ in., 1 9/16 in. or $1\frac{3}{8}$ in., according to how the chain happens to be winding on the drum at the time of full application. This maximum difference is but 5/16 in., yet in an actual dynamometer test it will be found that, with one man, there is often a considerable variation which is accounted for principally by this difference in the distance from the center of the shaft to the center of the chain.

The instructions in this report assume that the center of the hand is 3 in. from the outer end of the lever, which distance approximates a hand 6 in. in width. As a matter of fact we believe this distance is more nearly 2 in.

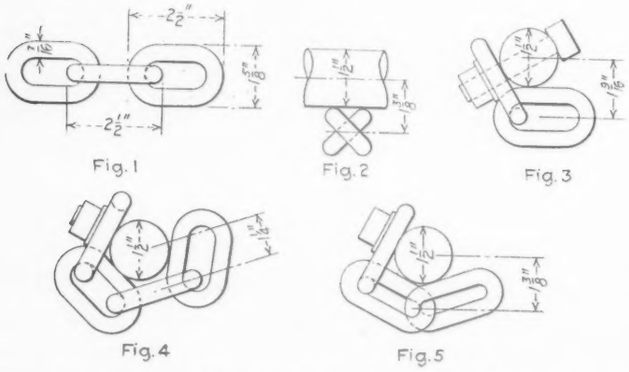
With a dimension of 19 in. from the center of the shaft to the end of the lever, and subtracting 3 in. as directed,

we would have 16 in., or the same as the value L for a 16-in. diameter brake wheel. On this basis the value for the ratchet lever referred to in the report would develop a chain pull exactly the same as with a 16-in. brake wheel, which is not borne out by dynamometer tests.

If the method suggested of taking 3 in. off of the distance from the center of the shaft to the center of the lever is followed when using a 28-in. club, we will have, referring to Fig. 6, practically the same condition as we would have with a lever 20 in. long.

If this method of reasoning holds good, it is equivalent to saying that practically no more braking power can be obtained by the use of a 28-in. club than with a wheel alone, which we know is not the case.

A test was made on May 10, 1920, with three brakemen in the presence of seven observers, most of whom were engaged principally in office work. The results of this test are shown in the table, from which it will be seen that the maximum chain pull obtained with a 16-in. wheel was 1,280 lb. against an average of 1,098 lb. Using a 28-in. club on a 16-in. wheel a maximum pull of 2,400 lb. was obtained by one of the brakemen, the average being 1,930 lb. A maximum chain pull of 2,500 lb. was made by the writer with an 18-in. leveraged ratchet and the average was 2,084 lb. With a 24-in. leveraged ratchet the maximum chain pull was 2,700 lb., which was also obtained by the writer, and the average was 2,308 lb.



Drawing showing different windings of the chain around the brake staff drum

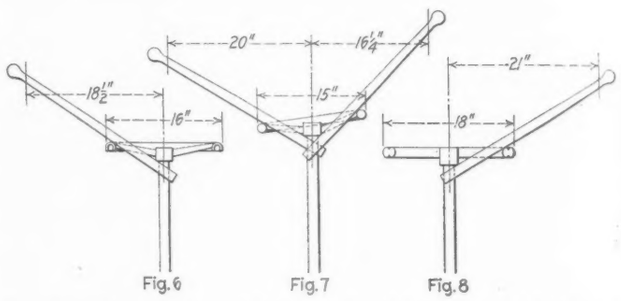
It will be noted that the use of the formulas recommended by the committee give a value of 1,600 lb. for the 16-in. wheel whereas the maximum chain pull in this test was 1,280 lb. and the average 1,098 lb.

According to the formulas the ratchet having 19 in. from the center of the shaft to the end of the lever should have given a pull of 1,600 lb. whereas the maximum was 2,500 lb. and the average 2,084 lb.

In studying this table it will be noted that there is a reading given for both maximum and "dog," and that the variations in these readings vary all the way from 200 lb. to 700 lb. The average pull was approximately 300 lb. The maximum reading means the greatest pull that was obtained in each test and the "dog" reading refers to the amount to which the chain pull dropped back when the shaft was allowed to revolve backwards until the pawl or "dog" engaged the ratchet wheel. This emphasizes the necessity for having as large a number of teeth as possible in the platform ratchet commensurate, of course, with the strength.

The minimum number of teeth used at present for new equipment is 16 and it would seem that it would be working towards greater efficiency of the hand brake to make this number 25. The writer has seen this number of teeth in a gear and it had ample strength. Another interesting point developed by this test was that instead of having a shieve to double the power of the chain pull, this pull was never within 10 per cent of the theoretical doubling that was supposed to result and it was sometimes less.

From data resulting from dynamometer tests it would seem correct to use in the formula an average pull at 2 in. from the end of a lever as 170 lb. and at the edge of a brake wheel as 100 lb. and the average distance from the center of the shaft to the center of the chain as $r = 1\frac{1}{4}$ in.



Drawing showing the various lengths of leverage obtained with a 28-in. club on 16-in., 15-in. and 18-in. hand brake wheels

There has been considerable agitation for the use of a booster in connection with the hand brake. Several devices placed on the market are quite ingenious and most of them will do exactly what is claimed for them with the slack in the brake rigging a predetermined amount. However, the pull does not always remain constant when this slack varies. The great objection to practically all boosters is the initial cost and the fact that as long as a brake wheel is used, the club will be used also. This means excessive braking power on these cars and trouble will result if the strength of the brake step is figured only for the power developed by the wheel and booster. It also has to withstand the power developed by the use of a brake stick.

The following example can be cited in order to show that this conclusion is not theory. About 1904, the writer designed a gear multiplying mechanism which was placed on about 1,000 ore cars. After this gear had been in use for some time it was found necessary to use a short leverage ratchet so as to prevent the brakemen from using a club on the hand wheel. Trouble was experienced afterwards because of friction in the gears when the end of the car bulged. The final result was that all of these boosters were removed and replaced by a ratchet which gave a predetermined amount of power.

Straight Pull On Chain		Meyers	Coulter	Peck	Courtney	Blackall	Clark	Emery	Straight	Peden	Taylor	Average
	Wt	175	162	146	180	173	135	150	160	178	150	161
16" Wheel	Max	1280	1100	1100	1000	1100	1200	1000	1100	1100	1000	1098
Only	Dog	1040	900	800	800	760	560	760	900	840	800	816
16" Wheel	Max	2200	1800	1800	1600	1900	2000	1400	2200	2400	2000	1930
28" Club	Dog	1500	1480	1400	1440	1400	1700	700	1500	2100	1400	1462
Ratchet	Max	2400	1800	2000	1600	2500	2240	2100	1900	2300	1600	2084
18" Lever	Dog	2100	1500	1500	1600	2000	1600	1700	1600	1760	1600	1696
Ratchet	Max	2400	2100	2400	2000	2700	2400	2440	2200	2240	2200	2308
24" Lever	Dog	2000	1300	2200	1500	2300	1800	2200	1920	2100	1900	1902

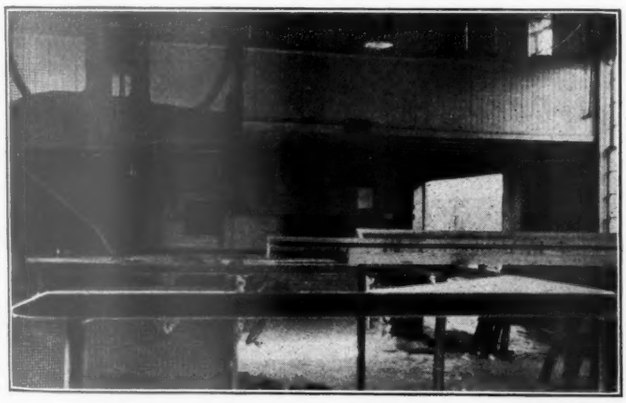
Table showing the maximum chain pull obtained in tests on various types of hand brakes

If the committee desires simply to establish an arbitrary method of figuring the hand brake power, it would seem advisable to employ the results of a dynamometer test as a basis. The formulas give too low a chain pull for all but the brake wheel, and this is too high. The lower the brake chain power the greater the necessity for multiplying this power in order to obtain the same chain pull as that developed by the air brake with 50 lb. cylinder pressure. The result will be more chain to wind up and there is hardly sufficient room at present for the chain to be taken care of properly. Because of this it would seem advisable to approximate more nearly the actual power applied at the rim of the brake wheel or to the end of the ratchet lever and thus get an efficient hand brake with a minimum amount of chain to be taken care of.

It will be of interest to note that the horizontal distance or leverage, of a 28-in. club as shown in Fig. 6 is 18½ in. This is the same as a ratchet lever having a distance of 20½ in. from the center of the shaft to the end of the lever and taking off 2 in. for the distance back to the center of the hand.

Cutting large pieces on a band saw

PRACTICALLY every wood shop has occasion at some time to cut large pieces of lumber on a band saw. The carpenter usually finds it somewhat difficult to perform such work as notching side posts and diagonal braces at the ends, for box and refrigerator cars on a band



A rail placed at the same height as the band saw provides additional support for large pieces

saw of the ordinary type without using a horse or trestle to hold up the other end. Quite often the side post or diagonal brace falls off the horse while the notch is being cut and breaks the saw. The arrangement shown in the illustration has been devised so that long pieces may be readily handled on a band saw without any possibility of accident due to the overhanging end falling off a trestle or other support. It consists essentially of a light rail bent as shown and placed at the same height as the table of the band saw. Triangular shaped filler boards are placed in each corner so that the operator may swing the work to any position desired without liability of it falling down inside the rail as it is swung around a corner. There is sufficient clearance between the rail and the table to allow plenty of room for the operator to handle small pieces. Another advantage in having such an arrangement is that a truck can be placed along side of the rail and each piece can be moved endwise across the rail to the saw and cut with a minimum amount of lifting and handling.

Device for cutting out holes in dust guards

THE usual practice in cutting the holes in dust guards is to chuck the guard on the face plate of a lathe and feed the tools to the work. The method used for doing this work at the Kingsland car shops of the Delaware, Lackawanna & Western is the reverse; i.e., the cutting tools are mounted on the face plate and the dust guard placed in a suitable holder and fed to the tools.

The method of mounting the tools in the face plate

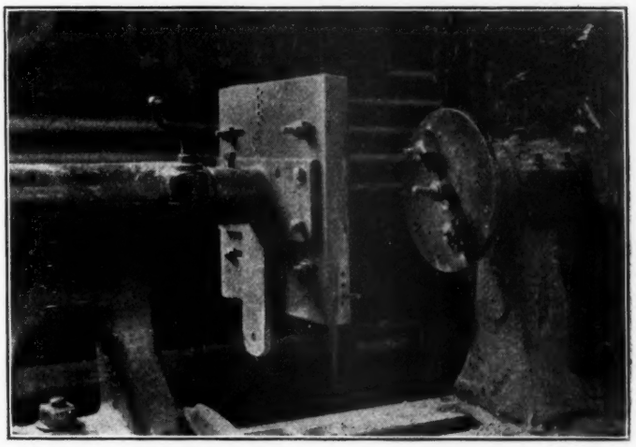


Fig. 1—Arrangement of adjustable cutting tools on the face plate of a lathe

is shown in Fig. 1. The tools are ground to a width of ¼-in. and placed in the toolholders which are adjustable for the purpose of cutting any diameter of hole required for any size of axle. The piece cut from the dust guard is pushed from the hole by a device extending from the lathe spindle. Its primary purpose is to warn the operator that the cut has been finished and that the dust guard should be set back to prevent the tools from digging into

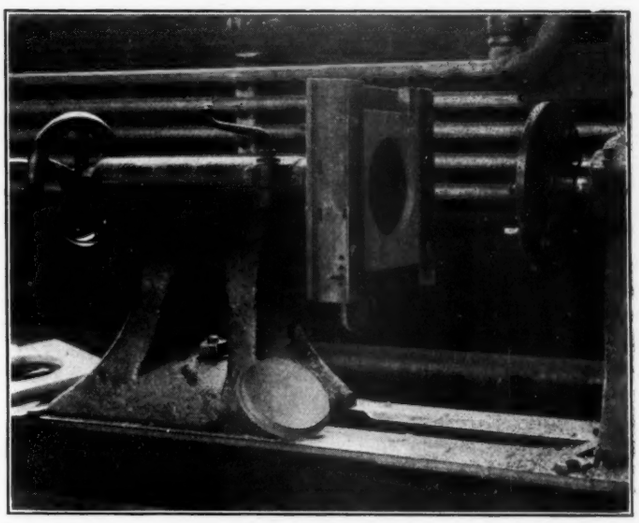
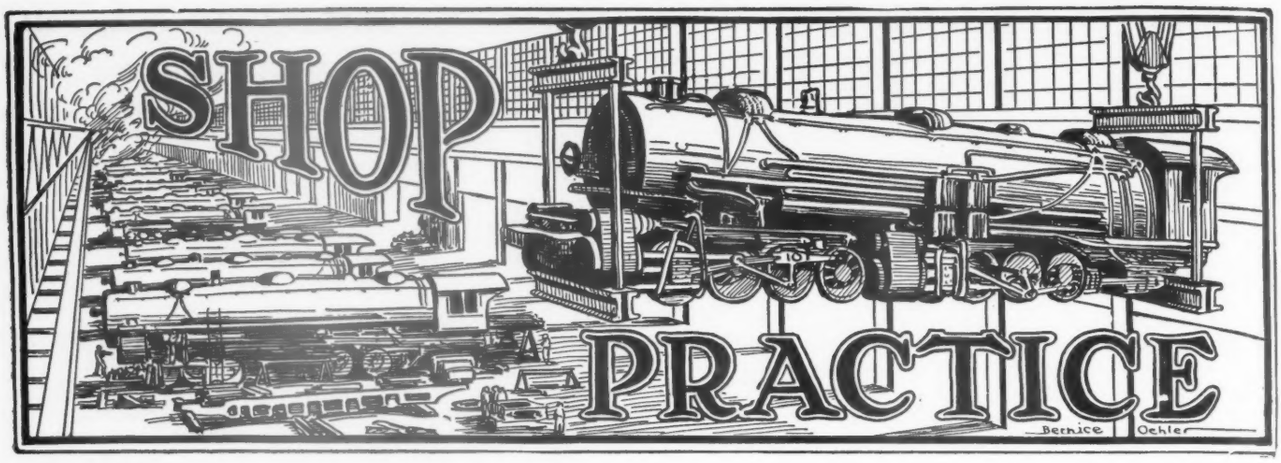


Fig. 2—Adjustable holder for holding various sizes of dust guards

the rear of the dust guard holder. The device consists of a bolt which fits in a bushing and has a nut and washer on one end and a spring at the other.

Fig. 2 shows the method of holding the dust guard. With this arrangement dust guards can be machined with great rapidity. The actual time to complete one piece is 45 sec.



Booster inspection and maintenance

Instruction of enginemen in handling boosters and close attention to lubrication are important maintenance factors

THE locomotive booster has proved an important factor in the increased utilization of the steam locomotive. Like many other appliances found on the modern locomotive it presents a new and somewhat different maintenance problem. A study of this problem on some of the railroads which have a large number of boosters in service brings to light the fact that the real solution of the booster maintenance problem lies in the prevention of trouble, rather than in the repair of the equipment.

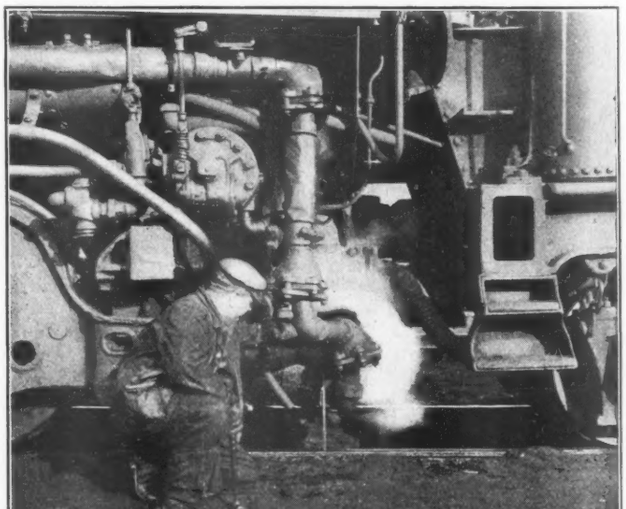
The Lehigh Valley, particularly, has been successful in the operation of booster equipped locomotives, and has 60 in service at the present time—50 Mikados in freight service and 10 Pacifics in passenger service. Two facts stand out rather prominently in studying the conditions on that road, viz.: first, that since the first booster was placed in service in March, 1923, there has not been an engine failure which could be charged to the booster and, second, that not one of the 60 boosters in service has yet been dismantled for a general overhauling. Some of these booster equipped locomotives have made more than 100,000 miles and the majority have made from 35,000 to 50,000 miles.

It has been found that the most successful way in which boosters may be maintained is to provide a separate organization to look after this work. Consequently, at each engine terminal where booster locomotives are cared for there has been assigned one machinist whose principal duty is to look after the booster equipment. These men are responsible for inspection and maintenance and render reports to the chief locomotive inspector, a system officer.

Much of the success of the Lehigh Valley in the operation of boosters may be attributed to the fact that when the first booster equipped locomotive was placed in service on the road, a great deal of stress was placed on the importance of properly instructing the men. As a consequence, classes were instituted in which special instruction pertaining to booster operation and maintenance was given to traveling engineers, enginemen and shop men. The traveling engineers made up the first classes of instruction in order that they might qualify to act as instructors of the enginemen.

Inspection

When a locomotive reaches the terminal at the end of its run, a thorough inspection of the booster is made while on the pit. While it may appear to be relatively unimportant, the first thing done by the inspector is to clean



A convenient method of checking the height of booster cylinder cocks

off, with an air hose, all of the coal and ashes that may have accumulated on top of the booster casing. This not only serves to make the top of the booster casing readily accessible in case it is necessary to remove the crank case cover for any reason, but it also lessens the possibility of dirt and ashes working into the mechanism.

The second step is to close the idler cock and idle the

booster engine. While doing this the inspector makes a careful inspection of all parts of the booster to make certain that there are no oil leaks. One of the principal points at which oil leaks occur is where the booster engine piston rod passes through the casing frame. There is an end cover plate here in which a 5/8-in. round packing is used as a wiper to prevent the loss of oil. This packing frequently becomes worn or deranged so that it is important to renew it if necessary.

While the booster engine is being idled, the inspector observes whether it is running at normal speed, to determine whether or not the preliminary throttle valve is functioning properly. While the inspection of the booster equipment is being made, it has been found advisable to set the independent brakes on the locomotive to prevent any possibility of the locomotive being accidently moved. The cut-out cock to the clutch cylinder is now opened and the booster latch is thrown in. This cut-out cock has been previously referred to as the idling cock, because of the fact that when it is closed the booster latch may be thrown

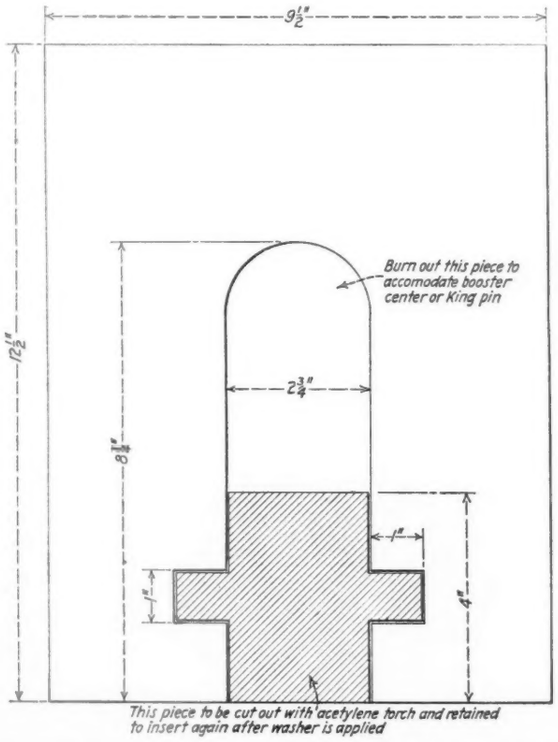

9½"
12½"
Burn out this piece to accomodate booster center or King pin
2¾"
8¼"
1"
1"
4"
This piece to be cut out with acetylene torch and retained to insert again after washer is applied

Plate washer for raising booster engine, the thickness of which can be made to suit conditions

in and the preliminary throttle valve will serve to supply steam for idling the booster engine without the clutch cylinder acting to throw the idler gear into mesh with the gear on the trailer axle. With this cock open and the booster latch thrown in the piping system to all the air control valves is filled with air under pressure so that a thorough inspection may be made with a torch to ascertain whether or not there are any air leaks in the control piping system. It is extremely important that a thorough test for air leaks be made because of the fact that a leak in the piping may cause some part of the air control system to fail to function properly while on the road.

At this point of the inspection it has been found advisable to observe the actual time required to close the cylinder cocks. Under normal operation the cylinder-cocks are automatically closed by building up pressure in the main steam inlet pipe, which acts on the main piston in the dome pilot valve. This piston, in raising, opens a small valve in the head of the dome pilot valve, which permits air to pass through the cylinder cock timing check valve and timing reservoir and causes the cylinder cock operating cylinder to actuate the closing mechanism. With the idling cock open the booster latch on the reverse lever should be thrown in and out several times to observe whether or not the main booster throttle valve is opening properly. The pet-cocks on the booster crank case should be opened to observe whether or not the oil in the crank case is at the proper level and oil should be added if necessary. The main locomotive throttle should be opened a sufficient amount to provide pressure in the booster steam line so that any possible steam leaks in the line or at the ball joints may be discovered.

The height of the booster above the rail should be measured and a plate washer applied if necessary. A clearance of five to six inches above the rail at the back cylinder cocks should be maintained in order to eliminate the possibility of any damage to the cylinder cocks from obstructions along the track. A very convenient method of checking this height has been found as follows: Directly over the rail on the inlet and exhaust manifold will be found a flat shoulder. By taking measurements it will be found that when this shoulder is 11 in. above the rail the clearance at the back cylinder cocks on the booster engine will be 6 in. One of the illustrations shows a simple yet effective method of making a plate washer to

Loco. No. _____

Lubrication				Repairs Made	
Date	Crank Case	Amt. Oil Added	Axle Bearings	Date	Description

Example of form used in keeping permanent record of booster lubrication and repairs

raise the booster engine. It is made from steel plate of the desired thickness and the crossshaped key cut out with an oxy-acetylene torch. The booster engine is jacked up to a height of at least twice the thickness of the washer and the washer inserted around the center pin. Then the key which has been cut out is dropped into the opening in the washer and the booster lowered into place. It is important that the inspector examine the cylinder cock rigging thoroughly to make sure that all parts operate freely. Enginemen's work reports frequently contain an item to the effect that the cylinder cocks on the booster do not close. Invariably this is found to be due to the fact that some of the rods on the cylinder cock rigging have become bent by striking something so that they prevent the rigging from operating freely. The full pressure and full power on the booster engine cannot be obtained with the cylinder cocks open and the importance of having them closed at the proper time is evident.

It is not only important that a thoroughly inspection be made at the end of every locomotive run, but also that an accurate record be made of each inspection. A permanent record form, which is illustrated, is kept for each locomotive, on which the inspector enters the date of inspection, a notation as to the condition of the oil in the crank case and the amount of oil added, if any. A column is provided in which the condition and attention given to the axle bearings is reported. On this form is also entered a record of any repairs which may have been made

to any part of the booster equipment. Inasmuch as these forms are made out by the booster maintenance men and inspectors at every engine terminal to which booster equipped engines are regularly assigned, the chief locomotive inspector who has supervision over this work is able at all times to know the condition of every booster on the road as well as to know what parts of the equipment require the greatest amount of attention. In this way these parts may be given special attention.

In testing booster equipment while the locomotive is on the pit, the cylinder cocks cannot be closed automatically without opening the main locomotive throttle valve, which as a general practice is not to be recommended. Therefore, in order to close the cylinder cocks manually the inspectors are provided with a small steel wedge which may be inserted under the spring seat of the upper valve in the dome pilot valve. This serves to close the valve which permits the air pressure to pass into the pipe leading to the cylinder cock timing check valve and timing reservoir and in this way the cylinder cock operating mechanism will work the same as though it was being worked automatically by the operation of the main piston in the dome pilot valve.

Opinions differ as to the proper time which should elapse after the booster engine has started to operate before the cylinder cocks close. The manufacturer recommends that a period of 20 sec. be established. But, on the Lehigh Valley, it has been found advisable to change this period of closing on different classes of locomotives to suit their particular operating conditions. Consequently, the practice has been established of setting the timing mechanism so that 10 sec. on locomotives in passenger service and 30 sec. on freight locomotives will elapse before the cylinder cocks close. The reason for this is that the booster on passenger locomotives is used only to facilitate the smooth starting of heavy trains, and consequently, it is desired to have the full power of the booster available immediately at starting. Inasmuch as a pressure of only 30 to 40 lb. can be built up in the booster engine cylinders when the drain and cylinder cocks are open, the time of closing on passenger locomotives has been reduced in order that the full boiler pressure may be available with a minimum loss of time. On locomotives in freight service where the booster is used at starting for a greater period of time it is not so important that the cylinder cocks close quickly.

Maintenance of booster equipment

Overhauling of preliminary throttle valve—Experience has proved that the greatest source of trouble in any part of the air control equipment will be found in the preliminary throttle valve and it has been found that if this valve is thoroughly overhauled every 30 days, very little trouble is experienced. A record is kept on the inspection and repair form previously referred to, of the exact date on which the preliminary throttle valve is overhauled and these records are periodically checked up to see that this work is performed at least once every 30 days. The principal operations in overhauling the preliminary throttle valve are grinding in of the steam valve, freeing the rings in the piston grooves, and a thorough cleaning and lubrication of the parts with a mixture of graphite and valve oil. Inasmuch as the practice of removing this valve at such frequent periods has been established, it has been found convenient to apply a union in the steam pipe on each side of the valve so that by breaking the joints at these unions it can readily be removed.

Throttle operating cylinder—This part of the equipment gives very little trouble and outside of a thorough examination and cleaning approximately every 90 days, very little attention is required.

Main throttle valve—The seat in this valve should be reground once each six months. In reassembling, the valve proper should be assembled in such a manner that it has freedom of movement on the valve rod. This can be assured by backing off the nut on the top of the valve rod a sufficient amount to allow the valve to adjust itself to the seat. While this work is being performed, the main steam valve should be re-packed if necessary.

Dome-pilot valve—This valve should be taken apart at least once each three months and the piston rings examined to see that they are free in the grooves. The spring should be examined to make sure that it is in good condition, and the outside valve should be ground in.

Cylinder cock operating cylinder—The piston ring in this unit should be thoroughly examined and cleaned at least every six months.

Reverse lever pilot valve—At least once each three months the spring in this valve should be examined and the inside and outside check valves reground.

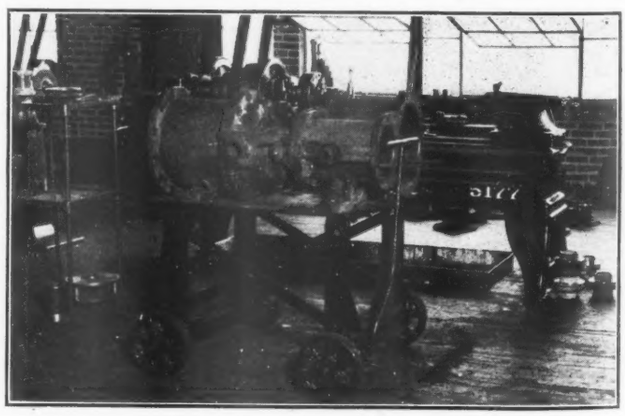
Conclusion

In considering the facts brought out by a study of conditions on the Lehigh Valley and the experience gained in maintaining booster equipped locomotives over a period of more than two years, the whole problem seems to bring out the vital importance of three factors—the thorough instruction of enginemen in the handling of the booster, proper lubrication and, finally, eternal vigilance in the inspection of boosters, together with the recording of information on inspections and repairs in such a manner that the supervisor in charge of this equipment may anticipate and prevent trouble rather than to make extensive repairs after damage has been done.

It may be well to mention the fact that the Lehigh Valley has made adjustments in the tonnage rating of all booster locomotives in order to take advantage of the full additional hauling capacity, the average increase in tonnage rating of booster equipped locomotives being about 10 per cent above that of locomotives not so equipped.

Portable bench for repairing air pumps

ONE of the numerous devices designed to expedite production in the air brake department of the Finley shops of the Southern Railway, North Birmingham, Ala.,



A portable bench designed to expedite repair work on air pumps and feed water heaters

is a portable bench used in the work of repairing air pumps, one of which is shown in the illustration. An account of the system used in the operation of the air brake department was included in a description of the Finley shops, published in the March issue of the *Railway Mechanical Engineer*.

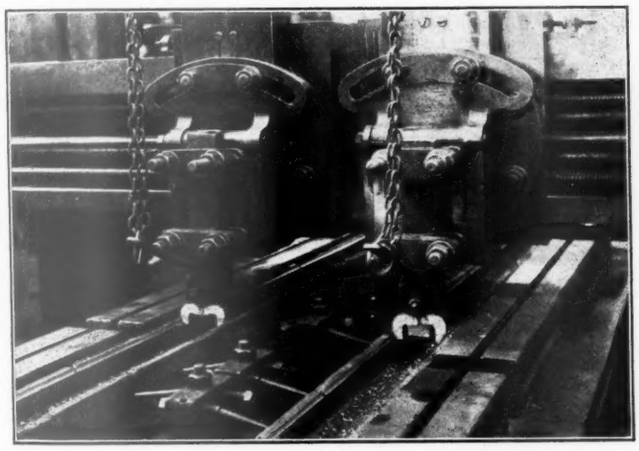
The frame of the portable bench or wagon is built of flat bar iron, securely braced to insure a rigid construction. The top is in one piece and is provided with holes so that a pump of any size may be bolted to the bench. With this bench pumps may be easily moved by the mechanic from bench to lathe and vice versa or to any other place desired. A portable bench of similar design is also being developed for feed water heaters.

Tools for planing driving box shoes and wedges

By E. A. Murray

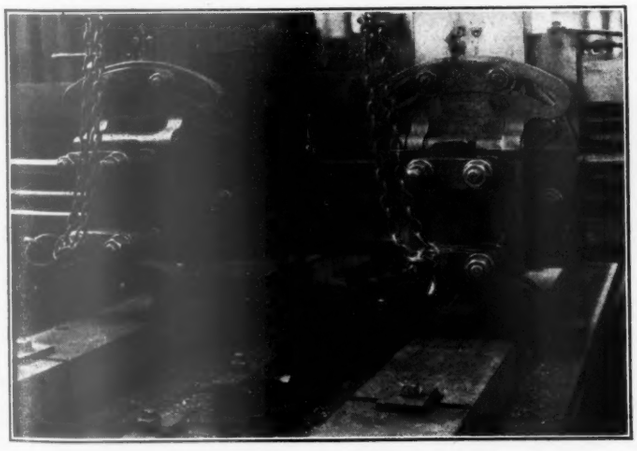
Shop superintendent, Chesapeake & Ohio, Huntington, W. Va.

TIME and labor factors are usually the prime motives behind the development of means to improve machine operations. Such was the case in design-



Planing inside of flanges with a double cutter

ing the tools, shown in the illustrations, which rough cut and finish shoes and wedges in two operations. After a set of castings have been laid off to driving box sizes, they are set up in two rows in a double head planer. They are



Using a double cutting tool to plane the outside flanges of driving box shoes

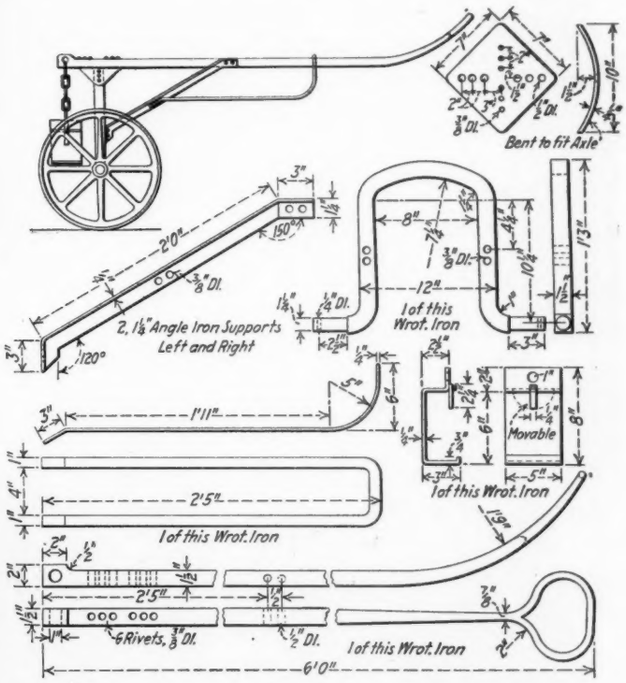
first finished on the inside for the frame fit by planing down the inside of both flanges at the same time, using a double tool. The castings are then turned over, placed on a mandrel and clamped in position when both flanges are planed outside simultaneously with another double tool, which is shown in one of the illustrations.

It will be noticed that both of these tools are made of unusually heavy material which greatly increases their weight and would naturally cause a heavy drag on the finished work on the return stroke. This objectional feature has been overcome by releasing these tools during the return stroke of the machine by the use of a pneumatic operated cylinder, which is connected to the tool post by suitable levers. The air is admitted to and exhausted from the cylinder by a lever which is connected to the reversing mechanism of the planer.

Two-wheel truck for handling rods

By E. A. Miller

A CONVENIENT truck for such work as handling rods from the blacksmith shop to the rod department is shown in the drawing. All of the parts, with the exception of the wheels, can be made in the blacksmith and machine shops. The axle is made from 1¼-in. wrought iron bar bent to the shape shown in the drawing. The handle is forged from 1½-in. wrought iron round bar and is curved up at the end so that it will be at a more con-


Bent to fit Axle
2, 1⅛" Angle Iron Supports Left and Right
1 of this Wrot. Iron
Movable
1 of this Wrot. Iron
1 of this Wrot. Iron
1 of this Wrot. Iron
6 Rivets, ⅜" Dl.
6'0"

Drawing showing the assembly and details of a truck for handling rods

venient height for the workman. The rods are slung on a wide carrier attached by means of a chain as shown in the assembly view. A detail of the rod carrier is shown at the right of the drawing immediately above the detail of the handle. It is made of ¼-in. wrought iron and is 3 in. by 5 in. at the base with a ¾-in. lug to prevent the rod from falling off.

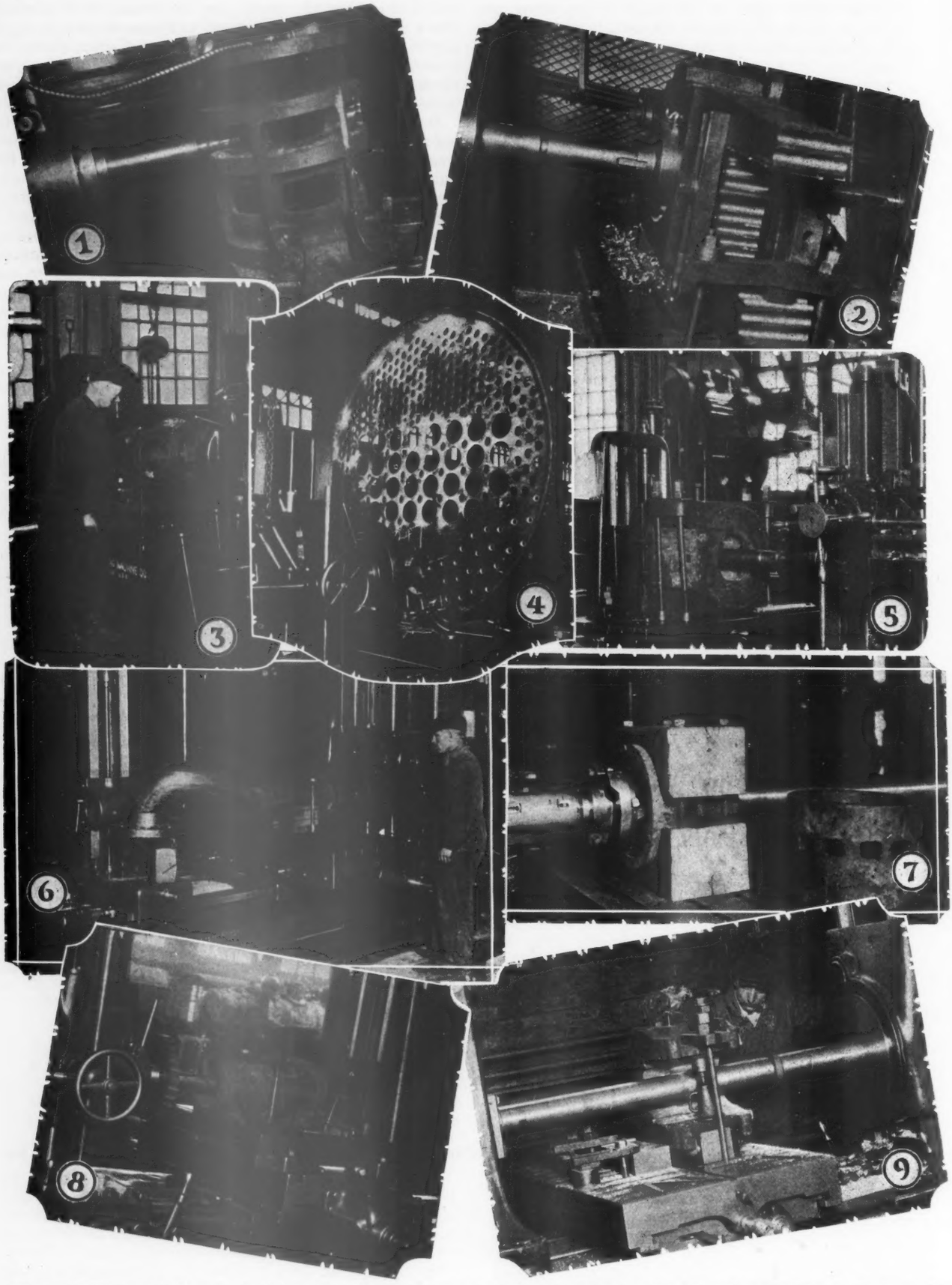


Fig. 1—Milling ports in valve bushing; Fig. 2—Boring out crank pin hole in back end main rod strap; Fig. 3—Boring cylinders of cross compound air compressor; Fig. 4—Boring out dry pipe hole in front flue sheet; Fig. 5—Boring out driving box and grease cellar in one operation; Fig. 6—Facing off branch pipe, using a facing attachment; Fig. 7—Boring out valve bushings; Fig. 8—Boring out cylinder of pneumatic pit jack; Fig. 9—Boring driving box crown brass

A versatile tool for locomotive repair shops

Horizontal boring, drilling and milling machine handles a wide range of work—Serves as a balancing medium in the shops

By Leroy R. Gurley

RAILROAD shops, particularly engine terminal shops and small back shops turning out 10 to 15 class repairs a month, handle repair work on a job rather than on a production basis. The machines in these shops are called on to handle a great variety of repair parts. These parts require many machine operations, such as boring, drilling, milling, facing, turning, shaping, planing and tapping. To provide single-purpose

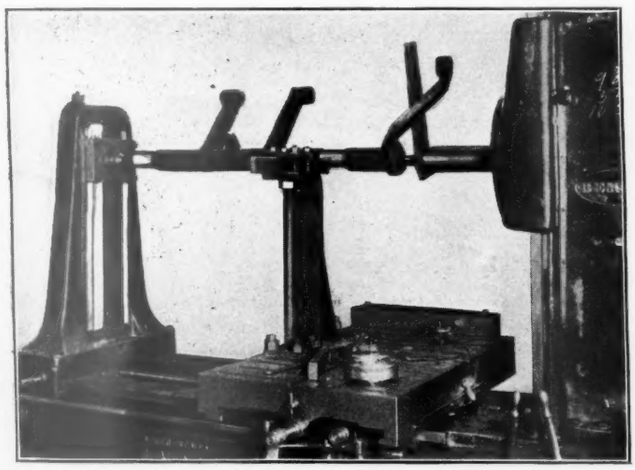


Fig. 10—Turning the bearings on a reverse shaft arm

machines for all of these operations is often impracticable. If a part to be machined requires several operations and production quantity is necessary, it is advisable to purchase a single-purpose machine for each of these operations, which would mean doing the several operations on many parts at the same time much more quickly than if all the operations were to be finished on one machine, one part at a time. But, in the small shop, where only a few parts of a kind are needed, a machine which will do as many of the operations on one part at one set-up as possible, is the most suitable.

A machine of this type is used in a somewhat different capacity in the large back shops. Owing to the fact that three different operations can be performed on this machine at one set-up it is used as a balancing machine to handle the overflow from the single purpose machines when they are crowded with work. It is also used to advantage when a regular machine breaks down. The back shops frequently have to handle large, irregular parts which can not be readily set up on the regular machines, or if they can be, it would not be practical to take the machines off from the regular repair work which they are assigned to handle. Therefore, large repair parts are assigned to a machine of this type owing to its versatility and the large platen, which is ordinarilly a feature of the horizontal boring, drilling and milling machines found in the average railroad shop.

Parts handled on the horizontal boring, drilling and milling machine

The horizontal boring, drilling and milling machine is well adapted for machining locomotive repair parts which require more than one operation. Its general design permits it to be used for machining parts at one set-up which would ordinarily require considerable trouble to set up on a single-purpose machine for but one operation.

Every railroad shop receives its share of parts such as those shown in Table I. Of course there are many parts which can be machined only on single-purpose machines regardless of the size or location of the repair shop. In examining Table I, however, it will be noted that the majority of the parts listed requires drilling, boring and milling, all three of which can usually be performed on this type of machine with one setting, and all the different cuts will be accurate in relation to each other. This elimination of the time consumed in changing the work

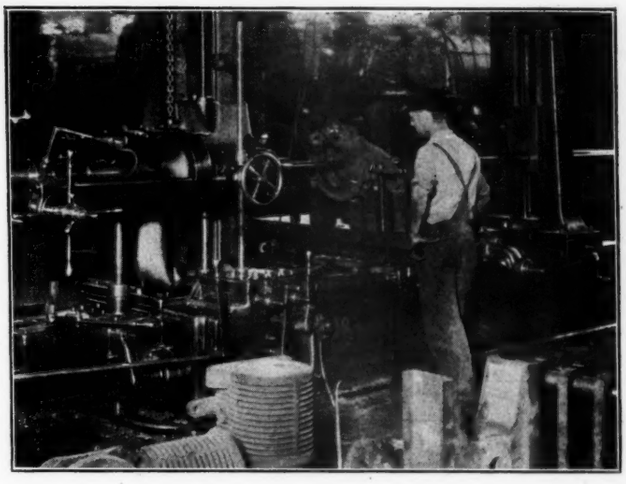


Fig. 11—Boring and facing a throttle box at one set-up

from one machine to another and the necessary resetting that would be required results in a saving in costs.

The machining of steam pipes is one of the most awkward jobs encountered in the railroad shop. Owing to its irregular shape, it is difficult to set up. Fig. 6 shows a machine of this type facing the joint of a steam pipe with the aid of a facing attachment. This effects a saving in time and labor by permitting the steam pipe joint to be faced and the flange bolt holes drilled and counterbored at one set-up. Machining crossheads is a common repair job in the railroad shop. Wrist pin and the piston fits are being faced, drilled and bored with one set-up by using

a swiveling table. Fig. 12 illustrates the method of doing this work.

Another job which the foreman dreads to see come on the floor is the turning of the bearings on a reverse shaft arm of a Walschaert valve gear, as shown in Fig. 10. In order to handle this set-up two centers were used, one to fit the taper hole in the spindle and the other to fit a bushing in the outboard support. The reverse shaft is placed on the centers and is driven with a carrier, the same as in ordinary lathe practice. The method of mounting the cutting tool, which is fed to the work by hand, is clearly shown in the illustration.

Locomotives frequently require new valve chamber bushings. This is a job which may be done at the engine terminal or at any locomotive repair shop. Part of the machine work on them requires that they be bored out and the ports milled to size. Fig. 7 shows the method of boring a valve bushing, while Fig. 1 illustrates how the ports are milled to size. All the ports can be milled at one setting by means of a swiveling table.

Table I—List of repair parts which can be machined on a boring, drilling and milling machine in the small railroad shop

Air compressor cylinders—boring, facing and drilling in one setting.
Air compressor center head—boring and tapping.
Bell standards—boring and drilling.
Booster engine cylinders—boring, facing and drilling.
Brasses, crown—boring, drilling and facing for lateral.
Brasses, journal box—boring and facing.
Brasses, main rod—boring, facing and milling flanges.
Check valves—boring and milling.
Crossheads—facing, drilling and boring wrist pin and piston rod fits in one set-up, using a swiveling table.
Crosshead shoes—milling.
Cylinder heads—back, guide fit—milling, one setting with swivel table.
Center castings, truck—boring.
Cellars—driving box—milling.
Deck castings, front—bored.
Driving boxes—bored, faced, filled, drilled and milled.
Eccentrics and straps—milling, tongue and groove.
Fulcrum castings—boring.
Fulcrum straps—boring.
Feed water heater cylinders—boring.
Flue sheets—boring dry pipe hole.
Gear frame, Walschaert valve gear—boring and facing.
Grate shaker cylinders—boring, facing and drilling.
Jaws, truck—milling.
Key seats, in axles—milling.
Link hanger brackets—boring, milling and drilling.
Link supports—boring.
Main rods—milling and drilling.
Tie head, steam pipe—milling and drilling.
Nozzles, exhaust—facing.
Piston rod extensions—boring, facing, turning and drilling.
Power reverse gear cylinders—boring, facing, turning and drilling.
Rocker boxes—milling and boring.
Smoke stacks—turning, facing and drilling.
Steam chest bushing—boring and milling.
Steam pipes—facing and drilling.
Side rods—boring and milling.
Stoker engine cylinders—boring, milling and facing.
Stoker troughs—boring.
Slide valve false seats—milling ports.
Slide valve steam chest—facing, boring and turning.
Straps, main rod—milling and boring.
Trailing trucks, roller seats—milling.
Throttle box—boring and facing.
Throttle standpipe—boring and facing.
Truck bolster—reboring worn pin holes.
Tumbling shafts—milling (with a gang of cutters) and boring.
Valve chamber head and valve stem crosshead guide—boring, facing and drilling.
Valve chamber bushings—milling port holes.

The operations of boring and facing a throttle box are done at one setting on this type of machine, with the finished surfaces in true alinement. Fig. 11 illustrates the method of setting up the job and the boring of the preliminary lift valve seat. After this operation, the main valve seat may be faced, if necessary. Something of the use which is made of these machines is indicated by the repair parts on the floor waiting to be machined.

How the machine can be used in the large shop

In the large repair shop it is the practice to issue shop orders calling for the machining of certain parts in lots which are to be distributed to engine terminals and smaller shops. By carefully analyzing locomotive parts to be machined, it will be found that there are many requiring several operations which are not called for in large enough quantities to permit organization of the work on a production basis. Typical examples of such work is the boring of booster, stoker, feedwater heater, grate shaker and power reverse gear cylinders. These parts, some of which are too long to be handled on an internal grinder, are being finished on the horizontal boring, drilling and milling machine in number of shops. Fig. 13 illustrates the method of setting up grate shaker cylinders on a machine of this type for facing both ends,

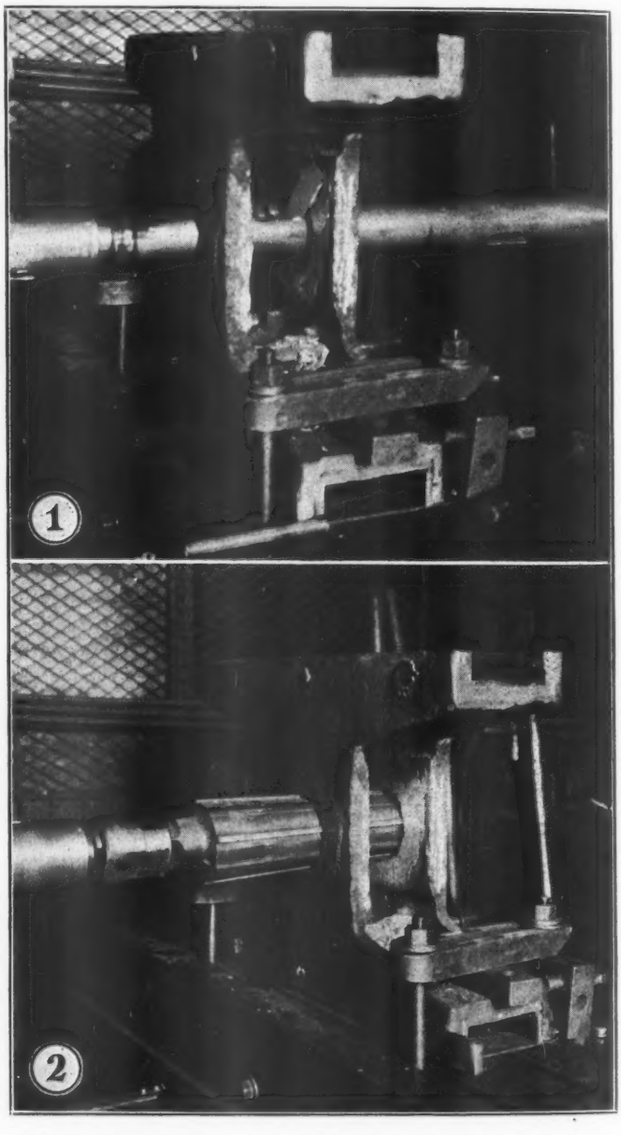


Fig. 12—(1) Facing the inside face of a wrist pin fit; (2) Reaming the wrist pin fit

rough and finish boring the cylinders and then, by turning the swiveling table 90 deg., boring the top of the casting. Steam pipe T-head jobs are also done on this machine. Fig. 14 shows a T-head being bored out and milled for the tube sheet connection at one setting.

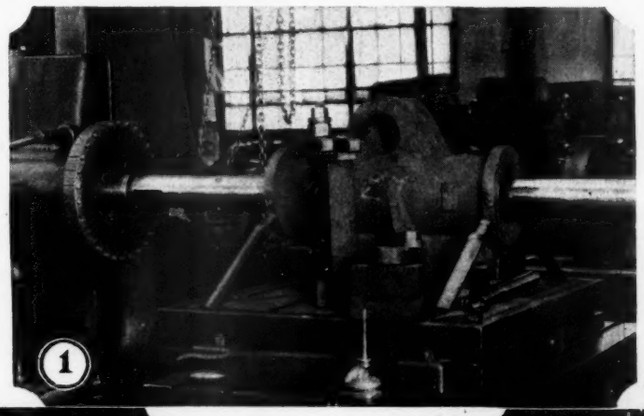
Many other repair parts are machined in the large shops which this machine can handle effectively in single pieces or small job lots, such as valve gear frames, link support brackets, steam pipe joints, piston rod extension guides, etc. Fig. 15 shows three link brackets being bored at one set-up.

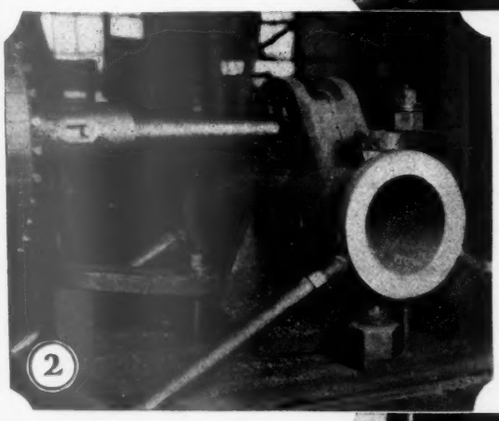
Handling the overflow from single-purpose machines

One of the important jobs of any large locomotive repair shop is the machine work necessary on driving boxes. They are generally passed through the shop on a schedule which often cannot be maintained due to the lack of sufficient machine tools to handle an unusual volume of driving boxes. The horizontal boring, drilling and milling machine is often called on to handle the overflow of work from these machines as it is capable of doing all the machine work on the boxes which the specialized tools will do. Fig. 5 shows a machine of this type machining a driving box and grease cellar at one set up. Fig. 9. shows another machine boring a crown brass, and Fig. 16 shows the milling of grease grooves in a driving box crown brass.

An additional example of the adaptability of this machine to handle the overflow of specialized machines as well as its versatility is the milling from the solid of the back end of a main rod. Fig. 17 shows a machine of this type milling out the back end of a main rod in two cuts in 4 hr. 30 min. from floor to floor. Fig. 2 shows the same machine boring out, in three operations, the main crank pin bit of a main rod strap. Table II shows the time required to machine other repair parts on a machine of this type. The last column of the table, which shows the time to complete the work, includes the time from floor to floor.

A machine of this type in the large repair shops has been used to advantage in reboring the cylinders of air compressors. The four cylinders of a cross-compound compressor can be quickly bored at one set-up. This method eliminates time and labor required for dismantling in order to rebore the cylinders separately. Furthermore, the machining of four cylinders at one set-up assures perfect alinement of the cylinder bores. The compressor head joints can also be faced or the stud holes drilled without changing the work. Fig. 3 shows a machine of this type boring out the cylinders of a cross-compound compressor.





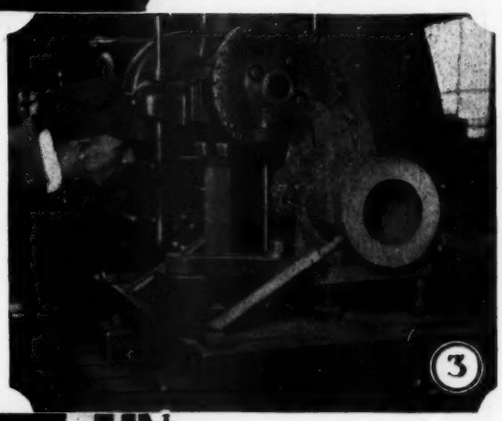
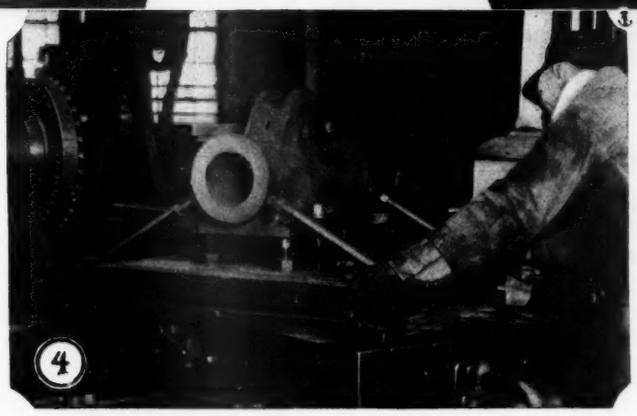


Fig. 13—(1) Boring grate shaker cylinder; (2) Boring operating shaft bearing; (3) Milling cutter facing end of cylinder; (4) Swiveling table makes it possible to perform all operations with one set-up.



Unusual job handled in the large shops

The horizontal boring, drilling and milling machine is called upon to handle some unusual jobs in the large shops. Fig. 4 shows a machine boring out the dry pipe hole in a front flue sheet. This job was the result of the failure of a machine in the boiler shop which regularly handled this work. Another unusual job is illustrated in Fig. 18 which shows a machine of this type milling the keyseat in a locomotive driving axle. Fig. 19 shows a machine boring out the back end brass of a side rod, which operation requires high cutting speed due to the soft metal.

The maintenance and repair of machine tools and shop equipment leads to the machining of many jobs other than locomotive repair parts. These jobs are often cumbersome parts which cannot be readily machined on some of the other types of tools. Furthermore, the other machine tools in the shops are usually engaged in their routine operations on locomotive repairs. Thus, the versaltility of the horizontal boring, drilling and milling machine enables it readily to handle these odd jobs. The machining of air hoist and vacuum pump cylinders, the masthead of a walking crane, as well as the various parts of machine tools are examples of such work which are handled by this machine. Fig. 8 shows a machine of this type boring out the air cylinders of a pneumatic pit jack.

The place of this machine in the railroad shop

There are several factors that should be considered before placing a machine of this type in the small shop or

at an engine terminal. First, the work should be analyzed to determine whether there is enough available to keep the machine busy. The work which can be handled only by such regular machines as the lathe, planer, shaper and drill press should be first eliminated from this list. These machines are indispensable in every railroad shop. The balance of the work should be considered from the standpoint of the number of operations which can be performed at one set-up, thus saving time in transferring the work from one machine to another. If it is found that there are enough such repair parts to keep the machine busy, then its purchase is justified. It would be a poor investment to purchase a machine of this type if it would have to stand idle a large part of the time, or be used on operations which can be performed as effectively on the single-purpose machines with which the shop is already provided.

Table II—Time required to machine locomotive repair parts which the boring, drilling and milling machine can handle in the railroad shop

	Material	No. of operations	Kind of operations	Time to complete Hrs.	Min.
Valve chamber bushing	Cast iron	6	Milling 6 ports	1	0
Air compressor cylinders	Cast iron	4	4 cylinders rough bored for bushings	3	30
Air compressor cylinders	Cast iron	4	4 bushings finished bored complete	4	0
Side rod	Steel	7	6 roughing cuts and 1 finishing cut	2	0
Engine truck center casting	Steel	2	Reboring pin holes for bushings with two settings	0	35
Milling shoe and wedge to line	Steel	1	Milling away ½ in. of stock	0	30

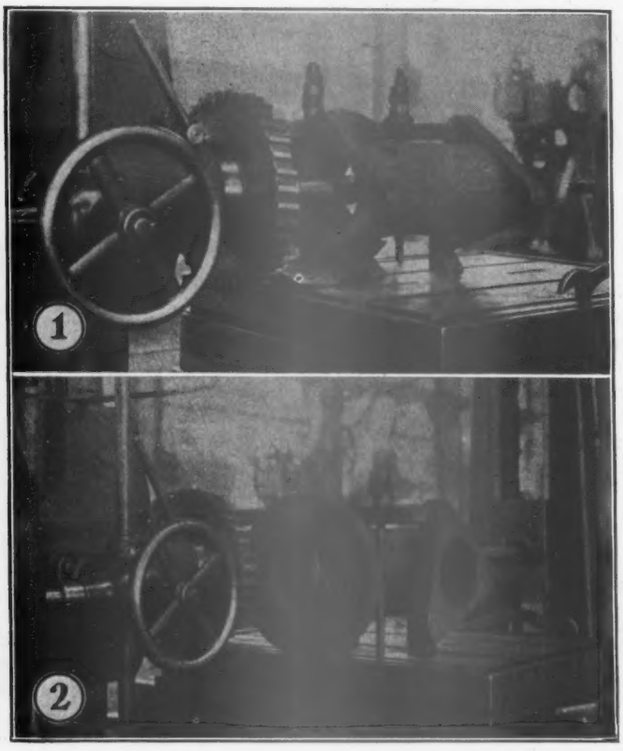


Fig. 14—(1) Boring out a T-head; (2) Facing off a T-head joint with a milling cutter—Both operations are done at one set-up

Side rod strap	Steel	1	Milling to layout marks	1	0
Valve gear crosshead arm	Steel	2	Face off electric welded shoulder	0	15
			Rebore pin hole	0	10
Valve gear rod	Steel	1	Reboring pin hole	0	20
Eccentric rod	Steel	1	Reboring pin hole	0	15
Main rod	Steel	2	Milling out solid end with two cuts	4	30
Crosshead	Steel	4	Bore and ream piston rod and wrist pin fits	5	0
Trailer equalizer	Steel	2	Drilling to holes	0	36
Locomotive driving box	Bronze	3	Setting up	0	30
			Rough bore	0	6
			Finish bore	0	4
			Chamfer	0	3
Back valve chamber head	Steel	1	Reseating worn seat	0	40
Side rod bushing	Brass	1	Bored	0	10
Throttle standpipe	Cast iron	2	Bore and face throttle stem hole	0	20

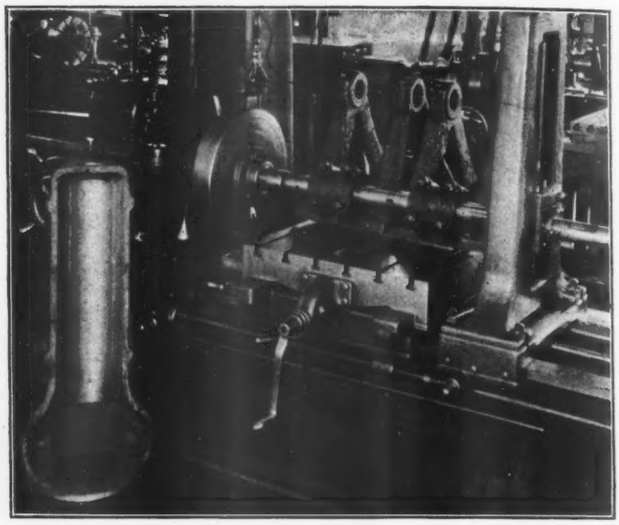


Fig. 15—Boring three link brackets at one set-up

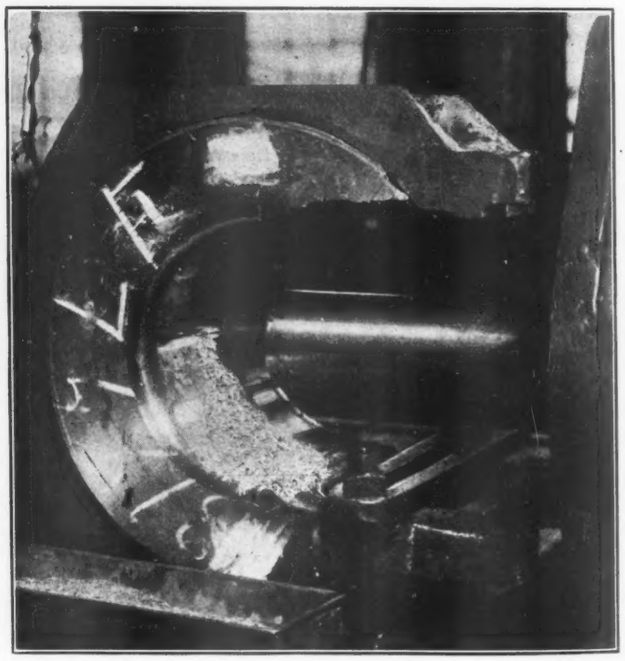


Fig. 16—Milling grease grooves in a driving box crown brass

It is well to keep in sight the fact already pointed out concerning the balancing function which this machine serves in both the larger and smaller shops. It is well to have in the shop a machine which can be used when the single-purpose machines are crowded with work or

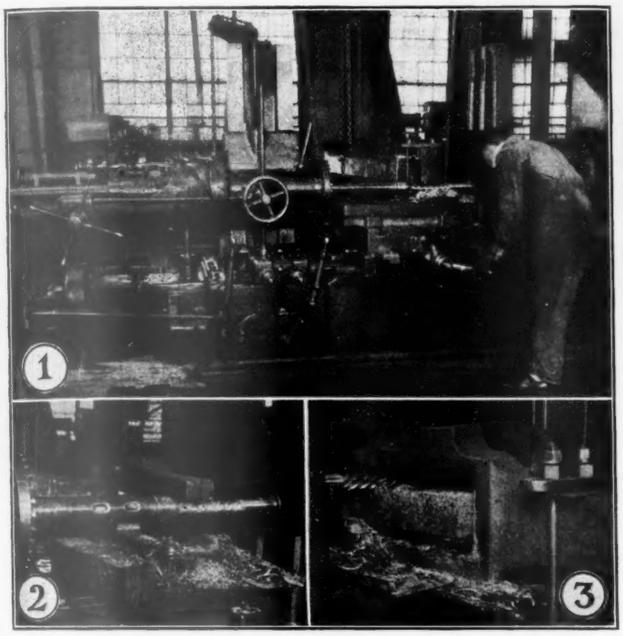


Fig. 17—(1) Starting to mill out the back end of a main rod; (2) Starting the second or finishing cut; (3) Ready to remove the block at the end of the first cut

a machine breaks down. The maximum of such protection can be provided with a minimum investment, by a multiple purpose machine, which can be used to good advantage in emergency.

The use of this machine in the large repair shops must be considered from a somewhat different angle. Repair

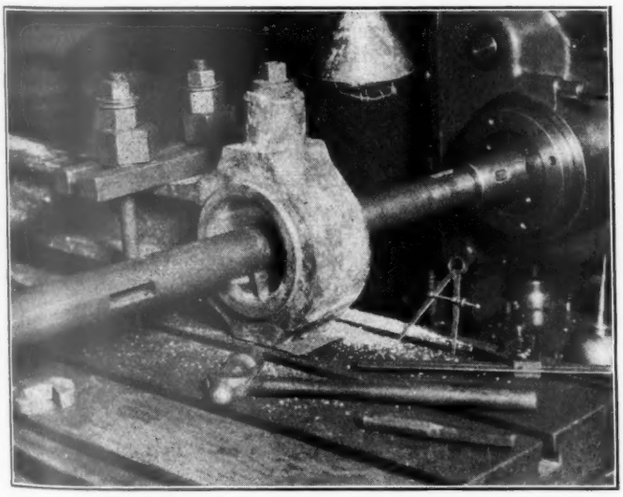


Fig. 19—Boring out the back end of a side rod brass

parts pass through the smaller shops in such limited numbers that it is not practical to install single-purpose machines to handle the work. In the larger shops the conditions are just the opposite as there are sufficient repair parts to warrant the installation of single-purpose machines. However, many parts which have more than one operation performed on them at one set-up, but which are never finished in large runs, can be machined

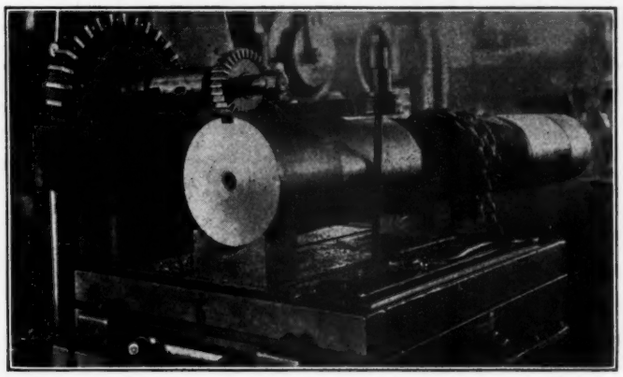


Fig. 18—Milling the keyseat in a locomotive driving axle

economically on a horizontal boring, drilling and milling machine.

Testing rack for brake cylinder packing leathers

By E. A. Miller

THE testing of brake cylinder packing leathers is one of the essential jobs connected with the maintenance of air brake equipment. To eliminate the usage of worn and leaking leathers it is imperative that they should be thoroughly tested on a suitable testing rack. The rack shown in the accompanying illustration is apparently well suited for this work.

The equipment is placed on and under a table, 1 ft. 7 in. wide by 12 ft. long and 33 in. high, which is built against the wall. Bolted to the table are two air brake cylinders, one 8 in. by 12 in. and the other 10 in. by 12 in. whose pressure heads have a ground joint instead of a gasket. Over each cylinder is a movable yoke, which when lowered in position serves the purpose of holding the piston in place against the testing pressure in the cylinder. The yokes are counterbalanced by a weight enclosed in a tubular covering, and connected to the yokes by a ⅛-in. wire cable. Beneath the table is a 16½-in. diameter reservoir, 11 ft. 6 in. long which has a capacity of 27,050 cu. in. It is charged from the main air line, in which there is a stop cock, through a feed valve which is adjusted to 55 lb. A two handed air gage, shown to the left of the table, is used; one pipe being connected to the main air line and the other to the pipe leading to the reservoir for the purpose of indicating its pressure. From the right hand end of this cylinder, a pipe leads up and back of the two cylinders on the table which supplies air to the cylinders through the back heads. A lever valve controls the supply of air and a gage is placed between it and the cylinders.

The top front end of the 8-in. cylinder is cut away 2½ in. on its diameter and the 10-in. cylinder 3½ in. and both cut back 5 in. on a curve as shown. This is done to permit the easy entry of the packing leather at the face and pushing it back into the increasing periphery of the cylinder until fully entered. Then it is pushed back as far as necessary to allow the yoke to be pulled down in a line with the center of the cylinder. The inside of each yoke is ground to permit it just to clear the non-pressure head and is then held in place by a latch which swings out of

place to allow the yoke to pass and return to place due to the weight at the end of the bell crank of the latch.

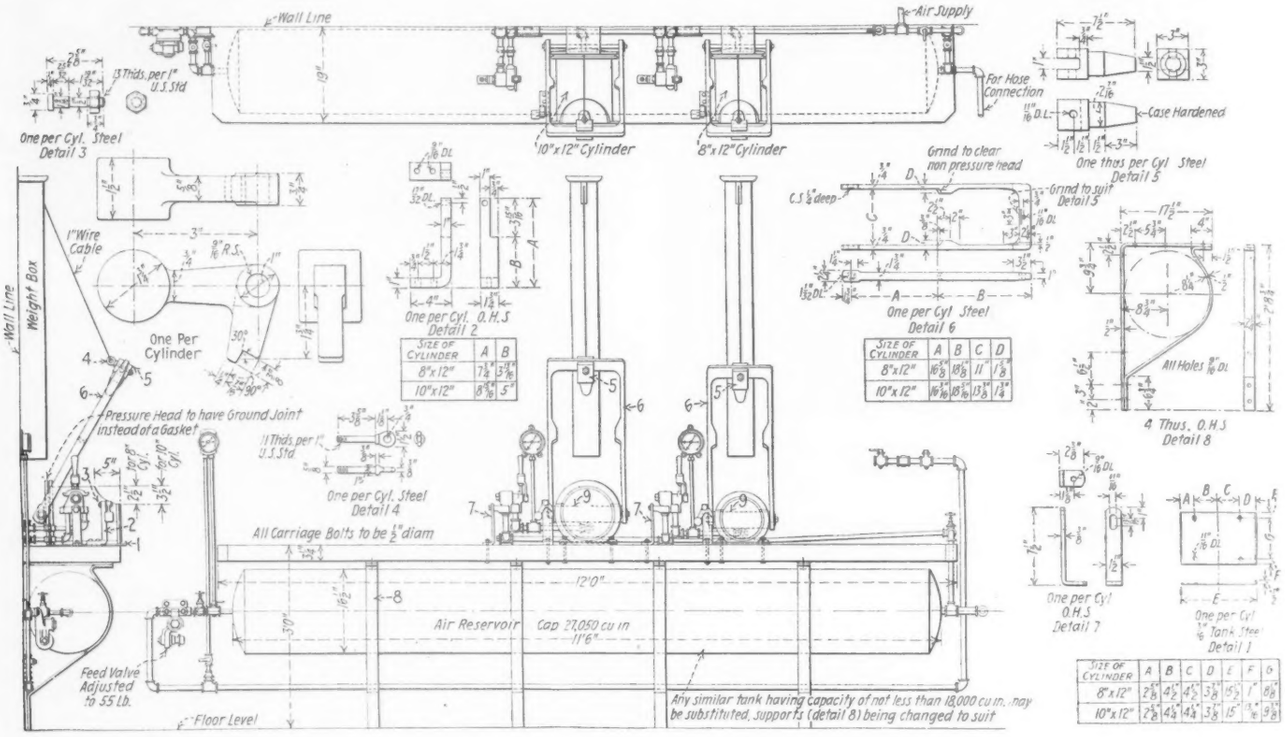
After the piston is in place, the air is allowed to enter the back end of the cylinder until the reservoir pressure is 55 lb. The air is then shut off and the rate of leakage is indicated by the cylinder gage. This test being completed, the valve is opened and the air is exhausted to the atmosphere. The piston and rod are pushed back to allow clearance for lifting the yoke after which the piston is quickly removed and another put in and tested. This arrangement permits the continuance of the work at a good speed.

Reaming an unusually large side rod knuckle pin hole

Storage rack for arch brick

By Joseph Smith

ARCH brick piled on the floor of an enginehouse takes up considerable room and there is also danger of the bricks becoming broken, due to the piles being knocked over or bumped into with trucks and heavy tools.


Wall Line
Air Supply
13 Thds. per 1" U.S. Std
For Hose Connection
Case Hardened
One per Cyl. Steel Detail 3
10"x12" Cylinder
8"x12" Cylinder
One thus per Cyl Steel Detail 5
Grind to clear non pressure head
Grind to suit Detail 5
C.S. ¼" deep
1" Wire Cable
Weight Box
Wall Line
One Per Cylinder
One per Cyl. O.H.S Detail 2
One per Cyl Steel Detail 6
All Holes ⅞" Dia
4 Thus. O.H.S Detail 8
Pressure Head to have Ground Joint instead of a Gasket
11 Thds. per 1" U.S. Std
One per Cyl. Steel Detail 4
All Carriage Bolts to be ½" diam
Air Reservoir Cap. 27,050 cu in
12'10"
11'6"
Feed Valve Adjusted to 55 Lb.
Floor Level
Any similar tank having capacity of not less than 18,000 cu in. may be substituted, supports (detail 8) being changed to suit
One per Cyl O.H.S Detail 7
One per Cyl Tank Steel Detail 1

Size of Cylinder	A	B
8"x12"	7⅛"	3⅝"
10"x12"	8⅜"	5"

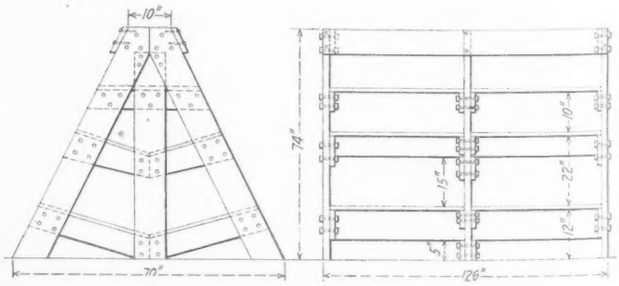
Size of Cylinder	A	B	C	D
8"x12"	16⅜"	13⅝"	11"	⅛"
10"x12"	16⅜"	13⅝"	13⅝"	¼"

Size of Cylinder	A	B	C	D	E	F	G
8"x12"	2⅝"	4½"	4½"	3⅜"	15½"	1"	8⅛"
10"x12"	2⅝"	4½"	4½"	3⅜"	15"	⅜"	9⅛"

General arrangement and details of testing rack for brake cylinder packing

The rack shown in the sketch is convenient for storing arch brick in enginehouses as well as in the erecting shop. The ends and center piece are made of 2-in. by 6-in. timbers, bolted together by ½-in. bolts. Planks, which serve as shelves, are spiked to the cross pieces, as shown in the sketch.

This rack is placed in a central location in the enginehouse. It will accommodate about 650 bricks of the various types and is kept supplied by a laborer. It is convenient for the hot worker and eliminates the necessity of having to go to an outside storehouse in inclement weather. As brick is taken from the rack, an order blank is filled out and placed in a metal container on the rack. These orders are periodically collected by the stores department.



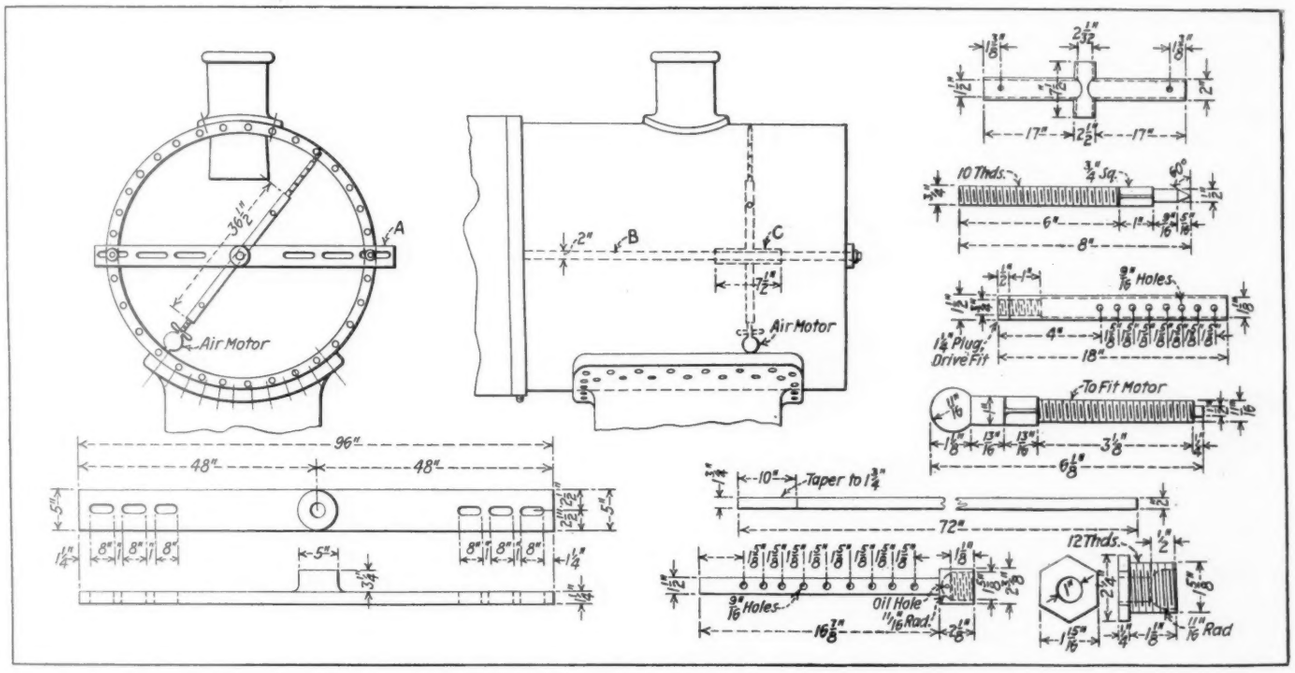
A rack for storing arch brick in the engine house

Device for drilling saddle bolt holes

THE customary method of holding the air motor in position when drilling cylinder saddle holes is with an "old-man." Its use necessitates changing its position many times which requires considerable time and labor. It is often a problem to know where and how to fix or bolt it in order to drill certain holes. The device shown in the illustration does away with the "old-man" and makes the job a one-man operation.

The cross-arm *A* is fastened to the front end studs so that its center is near the center line of the boiler. Shaft *B* extends from the cross-arm to and enters the end of a flue or flue sheet hole, near the center line of the boiler. Sleeve *C* fits and slides on shaft *B*. It has two extensions, one to the motor and the other to the front end shell to act as a brace.

With this arrangement it is easy to swing and fasten the motor to any position thus permitting the drilling of all saddle bolt holes with one set-up. This device was developed in the Grand Rapids, Michigan, shops of the Pere Marquette.



General arrangement and details of a device for setting the air motor when drilling saddle bolt holes

Methods of selecting and training supervisors*

By G. P. Hodges

Division master mechanic, C. M. & St. P., Mason City, Ia.

I BELIEVE all supervisors should be selected, whenever possible, from the ranks. Of course, there always will be a time when it will be necessary to go outside for specially trained men. However, I advocate the practice of selecting your man from the ranks for it creates a better feeling with the rank and file as much depends on them to bring success to any industry. With any large railroad, it should not be difficult to find the right kind of timber for promotion to a minor supervisory position. Any supervisor who cannot find such material in his organization for promotion to a more responsible position, has neglected some of his duties as a supervisor.

A college education is not really essential, but a man should have a fairly good education, and if he is the right kind of man he will soon educate himself along the lines of his work. The late James J. Hill, once said, that he considered an educated man one that knew about all there was to know about the business he was engaged in.

The man you are considering for promotion, in the first place, should not even be considered until he has conclusively proved his ability in his former position. He must be ambitious, and a tireless worker. He should possess good judgment. This qualification is about as essential as anything else, for it is on this point that the most of us fail. If we all would think just a little more and decide to use good judgment, instead of at times, doing things without thinking of what will be the final outcome I am sure that those in a supervisory capacity could set a very good example for the men under them. Of course, I don't mean to insinuate that we don't think and use good judgment, in fact, I would be very much offended if some one stood up and told me I didn't use my head, but at the same time, we will have to admit that some of the things we do, perhaps look to our superiors as if we didn't have a head or if we have one, we didn't use it. So be sure that the young man you pick for promotion is a thinker, and thinks before he leaps. He should also have a pleasing personality, be persistent and have patience. He must also be a leader of men and must not be egotistical, as it does not work well with the rank and file. They resent egotism. As a rule, each man has to be handled just a little different. Many a man that we termed a "poor man" could have been made a "good man" if he had been handled right at the start.

As soon as I am attracted to a young man that looks promising to me, I watch him, inquire about him

*A paper presented before one of the Master Mechanics' meetings held on the Chicago, Milwaukee & St. Paul.

from the foreman, find out what kind of a citizen he is outside of the plant and, when I see him occasionally, I stop and talk to him about his work. I also try to find out if he is loyal to the company or, in other words, is interested enough in his work to be fair-minded in his dealings and will do just a little more than he is paid to do something a little out of line with his schedule. If I find him loyal as a workman, it can be generally figured that he will be loyal as a supervisor. After determining these facts, I ask him if he thinks he would care to become an enginehouse foreman. If he states that he desires to get ahead, I send him application blanks to be filled out, after which they are filed in my office, awaiting an opportunity for promotion. Of course, I do not go to extremes in this. I generally keep about four applications for enginehouse foreman and two applications for traveling engineers on file. In picking a traveling engineer if the man is a first-class engineman and thoroughly understands machinery and the air brake, then the only thing he has to prove is his ability to handle men.

We want only broad-gage men in supervisory positions. There is no place on a railroad these days for narrow men. They must be able to weigh the questions fairly, whether they involve friend or enemy, and at all times be absolutely honest in their decisions. This is the only way to get along with men and do justice to the company you work for.

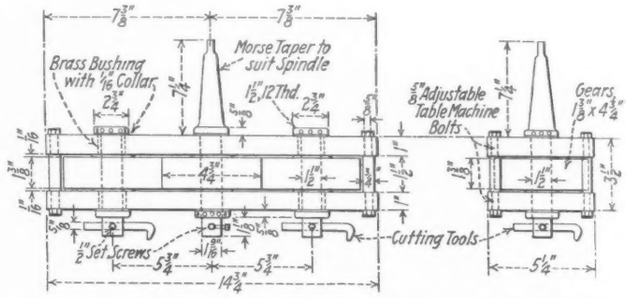
Merits of training schools for supervisory positions

I do not believe that a system of training can be inaugurated until the men are really familiar with the work. Most men get trained in the hard school of "experience." If the man you pick is working at a place where a slip foreman or a lead boilermaker is used, try and get him in one of these positions and with the right kind of supervision over him, he will, within a very short time, prove whether he is the man you want. If he does not prove successful, it is best to drop him out of the supervisory positions. There is no use dragging along with him as he will only prove a burden to himself and to the company.

It occasionally happens that we promote a night foreman to a day foreman, only to find out that he knows very little about the day work. Who is responsible for this? No one but the master mechanic and the day foreman; they have been neglecting their duty. I have all the sympathy in the world for a night foreman. He works in the dark and is generally kept in the dark. He generally has a very small force for the amount of work to be done; seldom ever sees any of the officers, quite often never sees the letters of instructions that are sent to the day foreman nor anything else pertaining to the running of the railroad. If anything goes wrong it is generally blamed on the night foreman. I seldom, if ever, go to an enginehouse but what I try to get to see the night foreman and talk things over with him. I also insist that certain instructions be given to the night foreman and have him acknowledge receipt of them to the day foreman. Most all circular letters that I send out have to be turned over to the night foreman to read, in fact, I try to have him made acquainted with all the facts that the day foreman gets.

Driving box oil grooving device

THE driving box oil grooving device, shown in the sketch, is designed to save time and labor as well as to obtain uniformity in all of the oil grooves on the shoe and wedge faces of the driving box. It is operated by a Morse taper shank designed to fit the drill press spindle. A driving box is placed on the table of the drill press, the taper shank of the grooving device is fitted into



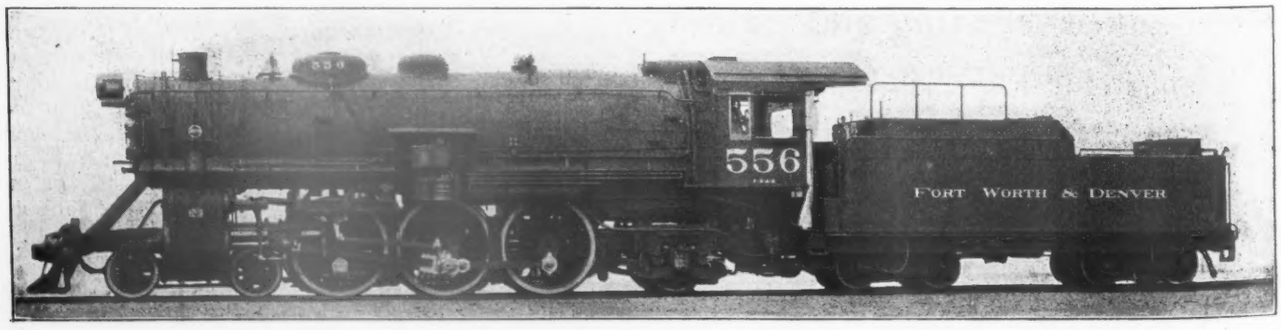
A device which will cut oil grooves on shoe and wedge faces to uniform depths

the drill press spindle, which is lowered to the shoe or wedge face of the box.

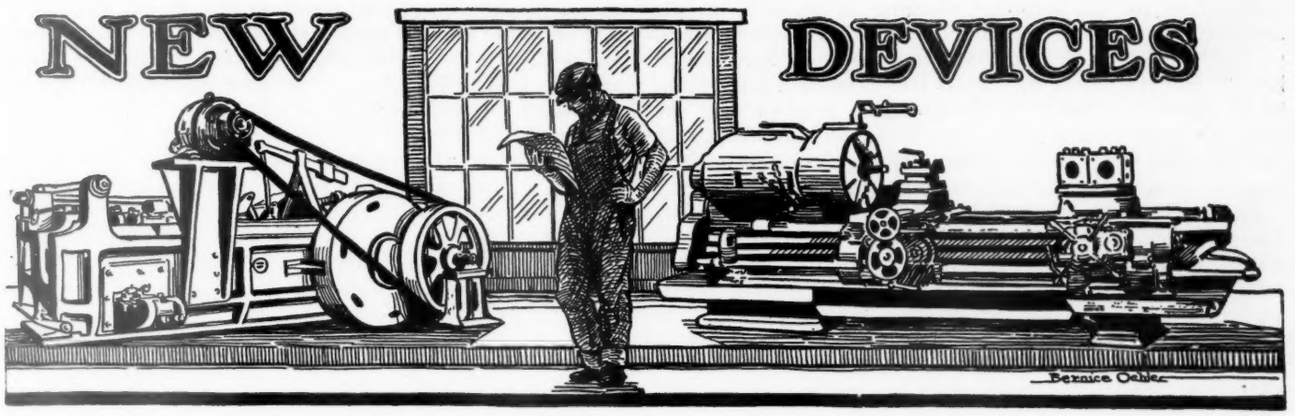
The cutting tools are turned by two gears which are held in a frame made of one-inch steel plate, 5¼ in. wide by 14¾ in. long. The center gear is rotated by the drill press spindle which meshes with the two gears that operate the cutting tools. By referring to the sketch, it will be noted that allowance has been made on the cutting tool gear shafts for the adjustment of the bottom plate.

The cutting tools are adjusted by means of the ⅝ in. adjustable machine bolts to suit the depth of the groove to be cut on the shoe and wedge face. The grooves are then cut to the required depth by the cutting tools which are turned by the three 1⅜ in. by 4¾ in. gears, shown in the sketch.

The principal advantage of this device is that all grooves have the same uniform depth which facilitates proper lubrication. This is practically impossible when the grooves are cut by hand.



Oil-burning Pacific type for the Fort Worth & Denver, built by the Baldwin Locomotive Works



Piston designed for gasoline rail car service

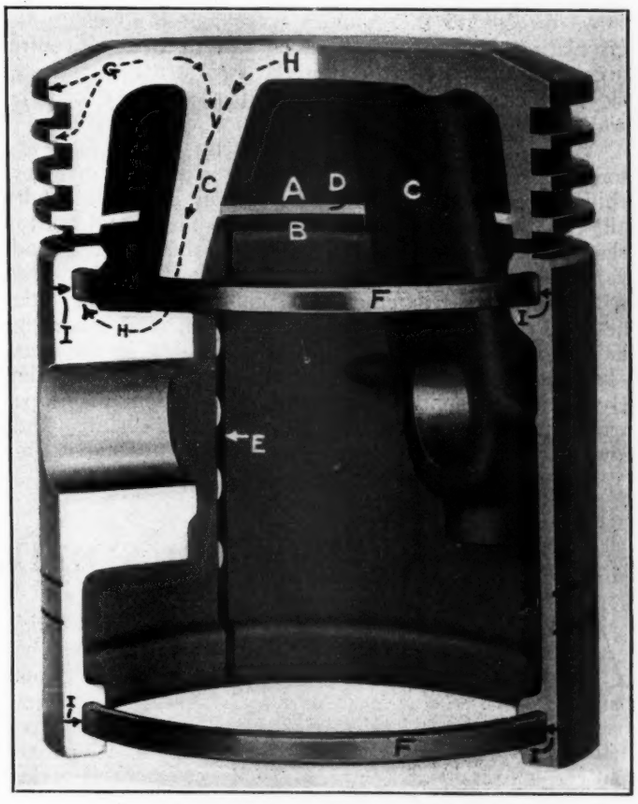
A NEW development which is assuming substantial importance in the railway field is the growing utilization of internal combustion engines as a source of motive power for major purposes. The gasoline hand car and track speeders have been a familiar sight for several years, and the gasoline passenger coach for rail service, while not so common as yet, is expanding its range of usefulness consistently.

This new field of service has brought the builders of automotive equipment face to face with a group of new problems, for the conditions encountered are radically different from those met by an automobile in road service. The automobile operates most of the time with throttle only slightly opened, being subject to full load only spasmodically and for short periods. The railway motor car, on the other hand, is driven on full throttle for many miles at a stretch without any chance to cool down or renew the oil film.

Thus a high temperature is built up and maintained without relief for long periods. But upon approaching a station or after topping the crest of a hill, the throttle is closed without declutching and the car coasts forward with little or no dimunition of speed. The engine continues to rotate and the pump circulates cold water over the cylinder walls at the same rate that it was flowing when working a full throttle, but combustion no longer occurs to produce heat. The cylinder walls are quickly chilled by this douche of cold water, and contract upon the piston, which cools much more slowly because not in direct contact with the water. In many cases this effect proved sufficiently drastic for the cylinders to bind the pistons fast, wrecking the motor and putting the unit completely out of commission.

In attacking this problem it became apparent that a practical method of controlling expansion and of governing the time of heat travel was essential to satisfactory performance. Extensive research in metallurgy eventually developed a method of producing an alloy of aluminum, copper and nickel in certain proportions, which assisted materially in solution of the difficulty. This alloy is particularly high in conductivity of heat, transmitting the calorific energy 3½ times as rapidly as cast iron does. Furthermore, this metal is very light and produces a piston weighing less than half as much as one of the same size made of iron, yet it actually wears longer than iron, is very hard, very tough and is not affected by the highest temperatures existing in a motor's combustion chamber.

But while these qualities made such an alloy very useful, the necessity for finding a way to regulate expansion was emphasized, for aluminum alloys expand twice as rapidly as cast iron when subjected to heat. Alloy pistons



Sectional illustration of a rail motor car piston

A, Piston head; B, Skirt; CC, Strut bars connecting the head to the piston pin bosses and transmitting the force of explosion direct to the connecting rod; D, Slot separating the ring belt from the skirt; E, Wave slit; FF, Steel bands controlling the skirt expansion; G, Path of heat travel from the outer portion of the piston head to the cylinder wall; H, Path of heat travel from the center of the head to the steel band controlling the skirt diameter; I, Direct path of the chill from the cylinder wall to the steel band.

for automobiles had been made with large clearances between pistons and cylinder walls when cold, so as to avoid the piston's becoming too large when heated. This had the disadvantage of giving poor compression in a cold motor,

with attendant oil pumping, drifting of gasoline to the crank-case to dilute the lubricant, and excessive wear.

But trouble more important than these is that caused by the fact that after the piston had expanded under heat to fit the hot cylinder, it did not cool as quickly as the cylinder walls cooled when drenched with cold water as the throttle was closed. The cylinder contracts more rapidly than the piston and seizure follows.

In order to overcome the problem of unequal expansion, a piston has been designed to take advantage of the conductivity of the improved alloy, known as Nickel-metal, which distributes heat rapidly from the centers of highest temperature to the cooler areas. In order to make the control of the heat more definite the head of the piston is completely separated from the skirt by a slot under the bottom ring. The head is attached to the piston pin boss by two substantial struts or bars of oval section. These transmit the pressure directly to the boss and the piston pin instead of putting the load on the skirt first and then on the outer end of the pin. The skirt carries practically no load at all, acting merely as a cross-head. The skirt, being entirely separated from the head, is comparatively cool and constitutes a capacious reservoir into which the heat of the piston head may be drained.

The struts supporting the head are cast in a location half way between the center of the piston head and its periphery. The heat of the outer portions of the head flows directly to the cylinder walls and is given to the circulating system for radiation. The heat of the central area is drawn down through the two struts to the cool skirt, where it is dissipated and passes to the cylinder walls.

A means of controlling the diameter of the skirt was sought in order to eliminate seizing when the cylinders chill and contract, also to gain precisely correct fit under all variations of temperature and do away with piston slap and oil pumping. In meeting this problem, advantage was taken of the fact that aluminum and iron will neither weld together nor combine chemically under heat. Two circular bands of low-carbon steel, about ¼ in. less in diameter than the piston, are cast in the metal —one near the top of the skirt, the other near the bottom. By means of splitting the cores, wave slots of proper width are provided on opposite sides of the skirt to allow space to compensate for expansion of the alloy. This slot is given a serpentine shape so that in case a piece of grit or other hard material should get into the cylinder and lodge in the slit it will be shifted from side to side and not cause damage by traveling up and down over the same path each time and causing a vertical scratch on the cylinder wall.

The steel bands are surrounded by alloy but are not fast to it, becoming in effect simply two tracks upon which the nickel-metal slides as the increasing expansion causes movement. The steel bands are of ample strength to prevent any enlargement occurring in the direction of the diameter, so the expansion is compelled to take place circumferentially, the metal sliding around on the steel bands partially to fill the wave slots on each side. Thus, the only expansion in diameter is that permitted by the expansion of the steel bands themselves, which is practically the same as that of the cylinders instead of that of the nickel-metal which is twice as great.

By having the head separated from the skirt, the desired control of heat travel and of rate of expansion and contraction is attained. To reach the steel band which governs the diameter of the skirt, the heat must travel from the center of the piston head down the struts to the pin boss, out the boss to the skirt, and up the skirt to the band. The result is that the heat of combustion, generated in the head of the cylinder, is transmitted to the cylinder walls more quickly than to the steel band of the skirt, so that there is no danger of the piston expanding more rapidly than the cylinder.

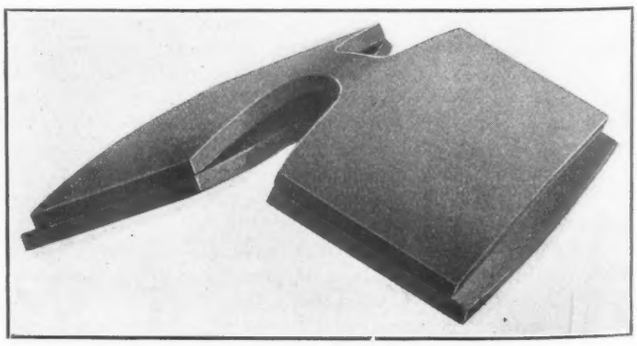
When the throttle is closed and production of heat ceases, and the flow of cold water cools the cylinder walls, the chill is imparted to the steel band immediately because only ⅛ in. of metal separates the band from the cylinder walls. Therefore, the diameter of the piston contracts quickly, remaining free of the cylinder walls as they cool.

It will be noted that this design causes heat to travel a circuitous route to reach the controlling steel band, while heat is conducted from it directly to the cylinder walls. Thus, is obtained the desired result of a piston which expands slowly under heat and contracts quickly under chill.

Pistons of this type are now being used with satisfactory results in a number of gasoline rail coaches. It has been placed on the market by the Butler Manufacturing Company, Indianapolis, Ind.

A friction spring bolster cushion

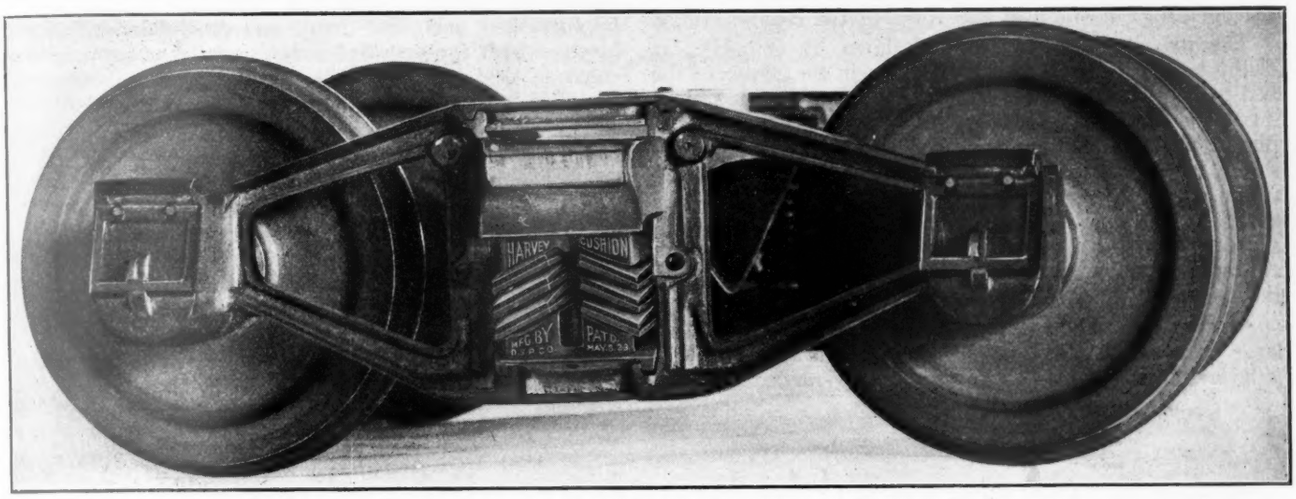
A FRICTION spring truck bolster cushion, which replaces truck springs of the ordinary type, has been developed by Frost Railway Supply Company, Detroit, Mich. This device known as the Harvey, friction bolster cushion consists of a top and a bottom malleable iron casting, called caps, and a series of concave and convex plates of spring steel. The plates and spring caps have angles sloping from the center outward, the top cap being concave and the bottom cap being convex. All plates and caps have the same angle with the horizontal. Each plate is cut out along the center axis into two sections which are joined by a narrow strip of the metal. It is this center portion or neck that is bent to give the two sections of each plate the correct angle to the horizontal. The whole assembly of plates and caps is held together by two long rivets. When the assembly is loaded, the lower heads of the rivets move down in pockets provided in the lower cushion cap. Only the ends of each pair of cushion plates are in contact on each side of the cushion. Each pair of plates is in contact with the next pair at the middle, and the top and bottom pairs are in similar contact with the top and the bottom casting.



A pair of the cushion plates

Thus it will be seen that as a load comes on the cushion each set or pair of plates bends closer together. Owing to the angle on the two sides of the cushion, the ends of each pair of plates must slide on each other. This slipping of the two plates that make up each pair is sufficient to produce several hundred foot pounds of absorption when the cushion is compressed and released. This absorption is said to be sufficient to stop the lateral rocking of the car. This rocking which is quite often caused by the time of vibration of the car body synchronizing with the passing of low joints, causes the bolster to move up and down on the side frame, when equipped with coil springs, as much as 1½ in. in the full capacity of the springs. In road tests of the Harvey cushion the maximum movement of the bolster up and down on the side frame is said to have been less than ⅜ in., which means that the rocking of the cars was very much reduced.

These springs are made to interchange with the ordinary nests of springs, so that they involve no change of standards. They are supplied in two classes, one for cars of 50 tons and under, and one for cars of over 50 tons. They can also be furnished for locomotive tenders.



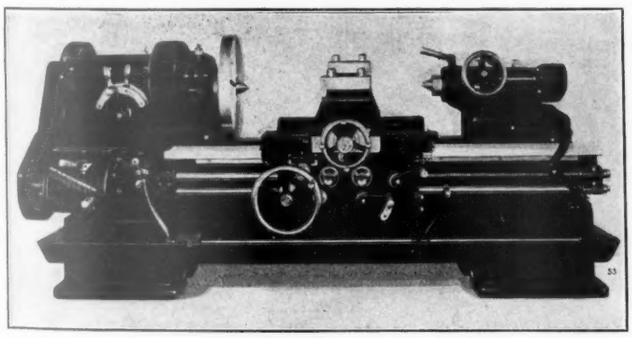
Application of the Harvey friction bolster cushion, showing how the complete assembly is held in place between the truck bolster and spring plank

A Monarch heavy production lathe

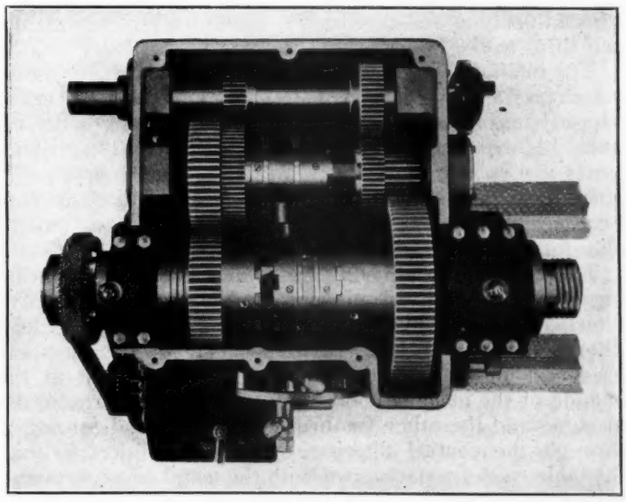
THE Monarch Machine Tool Company, Sidney, Ohio, has recently added to its line of tools a geared or cone head super-production lathe. The headstock gears are made from chrome nickel steel with face widths ranging from 2 in. to 3¼ in.

The auxiliary shafts in the headstock are mounted in a double row of heavy ball bearings. The spindle end thrust is also taken against a heavy ball thrust bearing. The sliding gears and clutches operate on large squared sections of the auxiliary shafts and spindle. Four or eight mechanical changes of spindle speeds are obtained by means of two levers on the front of the headstock which operates in a bath of oil. Either a constant or an adjustable speed motor drive can be furnished. The spindle bearings are exceptionally large—the front spindle bearing is 6½ in. in diameter by 10 in. long.

A 20 or 25-hp. constant speed or 3 to 1 variable speed motor can be mounted either on the floor at the rear of the headstock or on top of the headstock. The drive is through a silent chain to a large friction clutch sprocket



Monarch 26-in. by 10 ft. lathe



Four-speed geared headstock with auxiliary shafts mounted in heavy double row ball bearings

on the initial driving shaft. A constant speed motor of approximately 850 r.p.m. or less should be used. The friction driving clutch is capable of transmitting full power to the lathe and is operated by a lever at the right hand wing of the apron. An additional lever is attached to the apron enabling the operator to start, stop or reverse the lathe electrically, and in case of a variable speed motor, to secure any spindle speed electrically from the operator's position at the front of the lathe carriage.

The massive tailstock is held down by four 1¼-in. clamp bolts. There is also a rack cast in the center of the bed to help support the tailstock and keep it from sliding on the bed. It is provided with a hand-wheel and rack pinion for ease of moving. The thrust of the tailstock screw is taken against a heavy ball thrust bearing, between the shoulder of the screw and the end of the tailstock. The travel of the tailstock spindle is conveniently arranged for the operator by means of a pair of mitre and spur gears, bringing the hand-wheel to the front of the tailstock.

All apron gears and studs are of heat treated steel. The large cross and longitudinal feed frictions are operated by a large ball handle, which is a great convenience in operation as it prevents feed slippage under the heaviest cuts. All apron bearings are oiled from one central oil reservoir. All gears in the quick change gear box and feed mechanism are of heat treated steel. Operating shafts are made of a special grade of high carbon alloy steel.

The carriage has been designed for strength and durability. The cross bridge is 14 in. wide and takes a bearing on the front flat of the bed. Any type of tool rest can be furnished, including front and rear independent tool blocks which are operated independently or brought to a common center at the will of the operator. They are provided with automatic diameter stops.

The machine is built in 26-in. and 30-in. sizes. The following are the principal dimensions for the 30 in. size: Swing over the carriage, 20¼ in.; distance between centers, 3 ft. 4 in.; hole through the spindle, 2⅛ in., standard, 3 in. maximum; taper of the center, No. 6 Morse; range of threads per inch, quick change 1½ to 23; range of feeds per inch, quick change 7½ to 115; number of threads and feed changes, 32; tailstock spindle diameter, 5 in.; carriage length, 36½ in.; size of lathe tool, ⅞ in. by 1¾ in.; speed of geared head driving pulley, 150 r.p.m.

Betts double housing guide planer

THE Betts Works of the Consolidated Machine Tool Corporation, Rochester, N. Y., has recently completed several heavy duty planers of special design for one of the locomotive builders. These machines are used for planing locomotive guides and similar work, where, in order to get maximum production, it is desirable to cut in both directions. In order to accomplish this purpose two sets of housings are used, each carrying a crossrail on which are mounted two heads. As the two crossrails face each other two of the cutting tools are constantly at work. One set of housings is bolted to the bed in the usual manner. To accommodate the varying lengths of the work, the other set is adjustable along the bed by means of suitable slides, screws and nuts. A separate motor is used for moving this set of housings to the desired position and provision is made for securely clamping them to the bed.

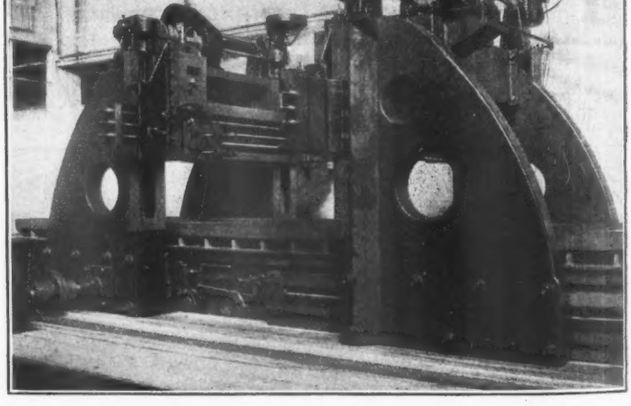
The main drive is by means of a 50 hp. reversing motor which has a speed range of 250 to 500 r.p.m., the entire range being used for cutting only; in other words, the usual high return speeds are dispensed with. The driving gears and rack are all steel, of wide face and coarse pitch, suitable for transmitting the high power required in connection with the heavy cuts that are usually taken on this class of work.

The table tracks, driving gears and driving gear bearings have forced lubrication in connection with a positive filtering system which insures an ample supply of clean filtered oil to these important bearings. Two pumps are used, driven by an independent motor mounted on the outside of the machine, one for forcing the oil through the machine and the other for bringing it back and forcing it through the central filtering unit. In addition to this, the table tracks are equipped with the usual oil pockets and rollers.

All four heads have electric feed and power rapid traverse. Both the feed and traverse are actuated by two electric feed motors, one for each set of uprights, and these same motors also furnish power for raising and lowering the crossrails.

The crossrail is clamped to the housings at both the inside and outside edges and is carried back between the housings a sufficient distance to provide ample rigidity when the tools are cutting close to the center of the table. The table is of the box type construction, and is gibbed to the bed for its full length to prevent any tendency to rise due to heavy cutting, which is an important feature on planing machines of this size.

The bed is of the box section type made with wide distance between the table tracks, and carries the dead shafts on which the driving gears are mounted.



Planer, designed with two sets of crossrails to cut in both directions

The capacity of the machine is 57 in. between the housings, 31 in. under the crossrail and 20 ft. between the table pockets. Convenient push-button stations are used for controlling the various motors. This arrangement permits easy operation of the planer and is such that the operator does not have to move any great distance in order to stop the machine.

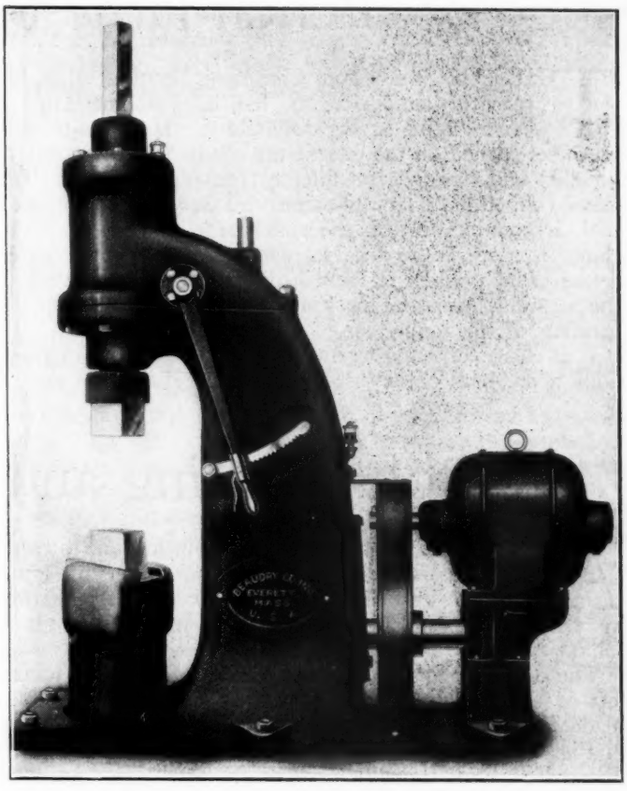
The Beaudry upright air hammer

THE Beaudry Company, Everett, Mass., has recently added to its line of blacksmith hammers an upright air-operated hammer. The compressor piston can either be driven by a belt-driven pulley or a motor. In operation the piston, when ascending, compresses the air above it and this flows into the ram cylinder, sending the ram upward with great speed. When near the top, air is trapped, forming a cushion, which causes the ram to rebound, and this, combined with the suction of the descending compressor piston, produces the hammer blow. The anvil which absorbs this blow is separate from the hammer frame and is supported on its own foundation, eliminating shocks to the hammer frame.

When equipped for belt drive, no countershaft is necessary as the hammer has a tight and loose pulley, the belt being shifted to the loose pulley only for long stops. The blow is regulated to suit the work by the foot treadle from a light, sensitive tap to the heaviest blow. The ram is held suspended when not working or when clamping the work for bending. Bars of any length may be worked either way of the dies.

The ram is designed so that the greater part of its weight is concentrated in a bar of large diameter, practically unbreakable, and is guided by passing through both the upper and lower cylinder heads. The head is entirely separate from the bar and can be readily removed when necessary to separate the ram from the cylinder, otherwise it is held securely to the ram by a wedge clamping ring. As the cushioning of the ram is done entirely by air, the use of springs or rubber cushions is avoided in this design.

The hammer is made in six sizes, with the weight of the rams ranging from 100 to 1,200 lb. The lift of the ram of the largest size is 26 in.; the number of blows, 110 per min.; the size of the motor, 40 hp., and the weight, 30,000 lb.



Beaudry upright, air operated, motor driven hammer

Portable electric circular hand saw

A PORTABLE, electric, circular hand saw adaptable for cutting car flooring, roofing and for general use about a car shop has recently been placed on the market by the Michel Electric Hand Saw Company, Chicago. It also can be used for cutting fibre, hard rubber, insulated cables, brass, light gage metal and many other materials.

Portable, electric, circular hand saw for the car shop

The body of the tool is made of No. 12 aluminum, which makes it light in weight and easy to handle. Every part of the tool is machined and is interchangeable. It has a cutting capacity of 2 in. in hardwood and will also cut many other materials requiring an equal power. It will groove or cut to any desired depth, up to 2½ in. Various attachments can be used for beveling or other purposes.

The motor used is of the universal type especially designed for this kind of a tool. Two types of motor are furnished, one for 110 volts a.c. or d.c. and the other for 220 volts a.c. or d.c. which are air cooled by forced ventilation. The saw is equipped with a trigger switch, the purpose of which is to insure safety, as the operator's finger must be held on the switch in order to keep the motor running. The motor, fan and shafts are dynamically balanced in order to eliminate vibration while in operation.

When first starting to make a cut, the front guide is rested flatly on the material to be cut before starting the motor. It is always advisable to keep the cutter away from the material until after the motor is started, then the saw blade is fed into the material always keeping the

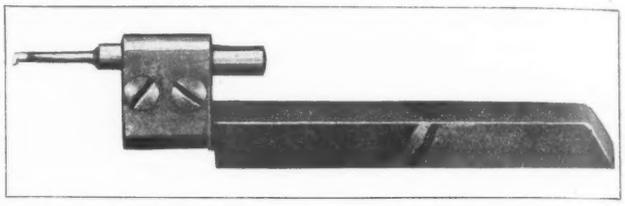
finger on the trigger. After the cut is completed, the trigger is released and the tool removed for a new cut.

The tool is known by the trade name of Skilsaw and is equipped with two 8-in. saws and 15 ft. of extension cord fitted with a plug which fits in any standard light socket.

Bench lathe boring toolholder

THE J. F. Smith Tool Company, Dayton, Ohio, has recently added to its list of machine tools a bench lathe boring toolholder. It is made with an offset turned on the end of the shank which is straight knurled and has a large fillet to provide strength. The clamp, which fits over the offset and also holds the boring tool, is countersunk on the shank side to clear it. The clamp is made in two parts, with screws binding in the center, which, when tightened, draw the clamp down into the straight knurl on the shank, preventing slipping and bending of the toolholder.

It is easily adjusted to different heights and is made to hold ¼-in. bars of any desired length. With the use of this holder an operator is enabled to keep his bar on center and parallel with the hole being bored. It is 4 in. long with a 5/16-in. by ½-in. shank.



Toolholder suitable for boring small holes

Bolt-pointing and threading machine

A MACHINE for automatically pointing and threading bolts that range in size from ¾ in. by 1 in., to ¾ in. by 6 in., has been placed on the market by the Economy Engineering Company, Willoughby, Ohio.

The operator fills the hopper located above and to the left of the machine, as illustrated in Fig. 1. A double-blade feeder, which is shown at the bottom of its stroke in Fig. 1 and at the top in Fig. 2, is automatically forced upward through the pile of bolts in the hopper and, on its way, gathers certain bolts the shanks of which fall between the blades. These are then suspended by their heads on the blade edges till, at the top of the stroke, the edges slop downward to coincide with a chute reaching from the hopper to the working section of the machine. The bolts then move down into this chute by gravity and the blade feeder returns to the bottom of its stroke and repeats to keep the chute supplied.

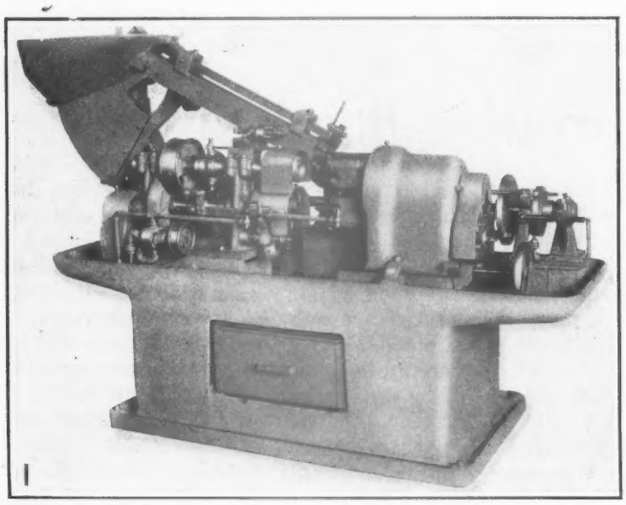


Fig. 1—Economy bolt-pointing and threading machine

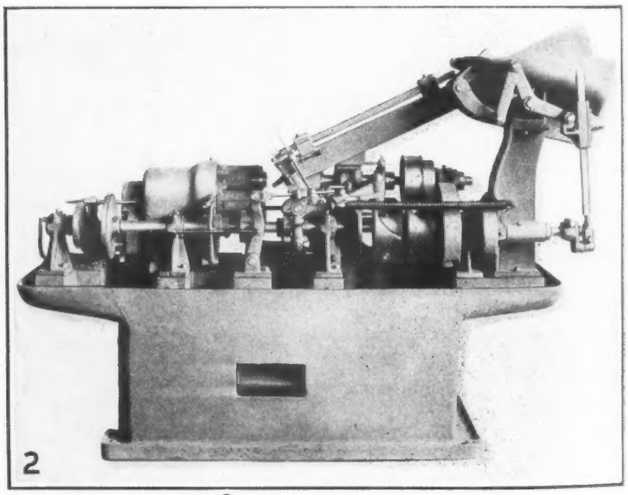


Fig. 2—Rear view of the machine

On the side of the chute near the lower end, there is an escapement that, by the operation two rods which alternately project into the path of the bolts, allows one bolt at a time to slide to the end of the chute where it is picked up by a transfer mechanism and carried to the chuck. This transfer mechanism is located, as illustrated in Fig. 2, at the lower end of the chute. It consists of a pair of cam-actuated spring fingers, which grip the shank of the bolt and deliver it to the chuck jaws, where the fingers are opened and returned for the next bolt that has been released through the escapement. The chuck jaws are operated by a cam-actuated toggle arrangement, illustrated in Fig. 2 at the left end of the machine. While a bolt is being placed for threading, the turret is locked against rotation.

When the bolt is gripped in the jaws, the turret is released and immediately indexed 120 deg. to come into position with the pointing head which is located, as illustrated in Fig. 1, in the upper center next to the lower end of the chute. This movement also brings the blank that has just been pointed into place for threading in the dies which can be seen in Fig. 1 below the pointing head. The completely threaded bolt is carried around at the same time to the loading station and dropped out as the chuck

jaws are opened to take the next bolt from the feeder.

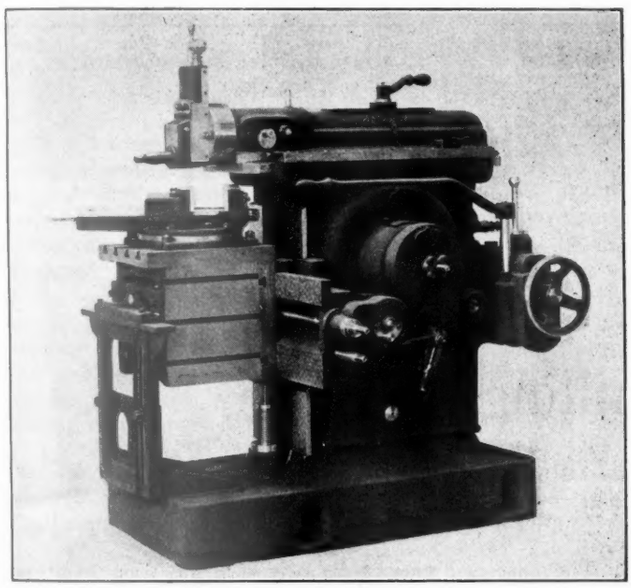
The pointing head and threading die are both fed forward by springs to reduce the possibility of jamming. Cams return them from the work. In the case of the threading die, there is a heavy spring for starting the thread that operates only for this part of the operation, when it comes against a stop and a light spring carries the head forward, overcoming only the drag of the moving parts. At the end of the stroke a cam opens the dies and returns the head to the starting point where another cam comes into action to close the dies, and then advances the head to position for the heavy spring to start the dies on the next bolt as it is indexed into position.

Change gears are provided to get the best ratio between speeds and feeds for a given size of work. The cams are arranged so they can be replaced to suit varying lengths and the turret head can be moved back after its clamps are loosened, to accommodate the longer sizes.

A capacity on ¾-in. by 1¼-in. U. S. standard bolts of 660 an hour is said to be attained.

Heavy duty back geared shaper

THE Stockbridge Machine Company, Worcester, Mass., has put on the market a 16-in. heavy duty, back geared shaper suitable for toolroom and die work. A gear box drive with a high ratio gearing provides ample power for heavy roughing cuts. The gear box is of the selective sliding type which works on the automobile shift principle.



Stockbridge 16 in., heavy duty back geared shaper

There are four changes of speed in the gear box and, with the back gears, eight changes in all are obtained. The gears are steel, heat treated and can be run in either oil or light grease.

The machine is driven and stopped by an automobile type of clutch which, when the machine is stopped, can be locked against any possibility of starting. This clutch is operated by a horizontal lever, which is extended to the front of the machine within easy reach of the operator. The ram can be moved back and forth, when positioning it, by this lever. A hand wheel is also provided on the side of the machine for hand setting the ram.

The base has been made of unusual depth for the purpose of strengthening it with deep ribs. A table support for the knee is carried on the base. This support gives a full width knee when in any position on the bar.

The cross feed will move the saddle in either direction by moving a handle to the right or the left without changing the position of the feed rod. The feed can be reversed without stopping the machine. It always operates on the return stroke of the ram and never feeds on the cut, thus eliminating the possible danger of breakage.

All the driving parts are heavily constructed. The vise is built to eliminate the overhang of the front jaw. It is also designed to keep the work as close to the top of the table as possible, the body of the base standing only 4½ in. from the top of the table. The jaws are 12 in. by 2½ in. and open to 12 in. The ram can be furnished with an automatic down feed.

Multiple spindle automatic screw machine

THE illustration shows a four spindle automatic screw machine of compact design, occupying a floor space of 116 in. by 42 in. and with a view of utilizing the full capacity of high speed tools, all of the machine members have been designed to insure permanency of alinement. This precaution is essential, due to the requirement of maintaining the dimensions of the product of automatic screw machines within close limits.

As this type of machine quickly accumulates many chips, a liberal amount of space has been provided between the tools and the chip pan. A further provision for the chips has been made by arranging the bed casting of the machine so that when the space directly under the tools has been filled with chips, any further accumulation is deflected by an inclined surface inside the bed at the center legs so that the chips can slide across into a compartment at the right hand side of these legs.

A door in the right leg of the machine gives access to a cabinet which accommodates the spindle speed change gears, which furnish seven changes of speed, ranging from 210 to 751 r.p.m.

A convenient feature of this machine is the design of a lever for opening and closing the chucks. As it is shown in the illustration, this lever is hanging straight down where it is out of the operator's way; but when it is required to put a new bar of stock into the chuck, or to release the chuck for any other reason, it is swung up on its pivotal support into a horizontal position. When so held, the rear end of the lever enters the space between the flanges on the chuck operating thimble, and then the hand lever is swung sidewise to open the chuck. When stocking up the machine, the spindle turret is indexed to bring successive spindles into the position where they can be engaged by this hand lever.

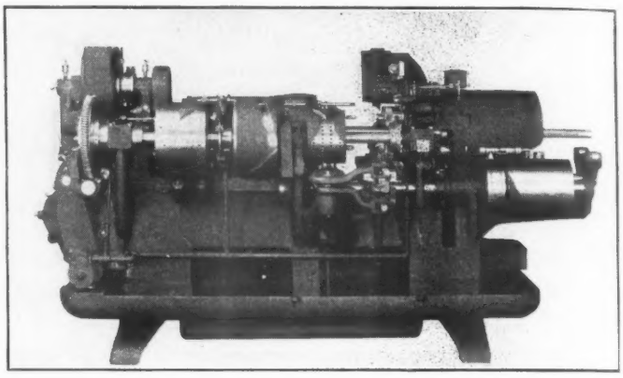
Of particular interest in the design of this machine is the arrangement of the high speed mechanism for effect-

ing indexing movement, and the low speed feed for controlling the working movements of the machine. There are two complete sets of gears for accomplishing these two classes of movement. For the high speed idle movements power is transmitted from a driving pulley, through bevel gears and a vertical shaft to a second pair of beveled gears and thence through spur gears to a worm meshing with a worm wheel on the feed cam shaft. These high speed gears are always running, but when the indexing movement has been accomplished, a clutch is automatically tripped by adjusting pins on the face of the worm wheel thus preventing further transmission through this drive.

The low speed drive for accomplishing the work feed movements is taken directly from the spindle driving gears. As a result, all feed movements, as expressed in inches per spindle revolution, remain constant regardless of how the spindle speed may be changed. From the spindle change gears, power is carried through suitable gearing to a pair of bevel gears which transmit to a vertical shaft, at the lower end of which there is a worm meshing with a worm wheel. From this worm wheel the drive is through a cone of spur gears and then through an intermediate gear controlled by a lever to a cross shaft which carries a ratchet.

Lubrication is an important feature. Oil is carried from the pump by individual tubes and delivered directly to the tool points where it is required. This eliminates the use of pipes above the turret. Attention is called to the fact that the oil pipes are of the telescopic type, so that they move back and forth as the tools advance to or recede from the work. As a result, the delivery of oil is always at the tool point. This is especially important in the case of the threading spindle, because by carrying the oil through the spindle and delivering it to the center of the die, the oil accomplishes the double purpose of lubricating the casers and washing out the chips.

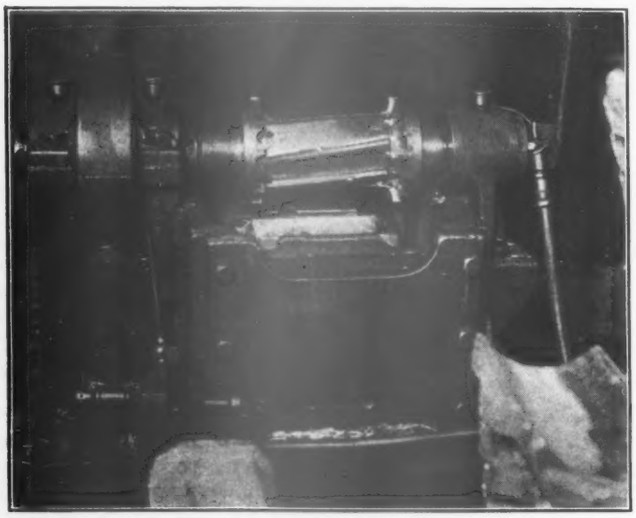
The machine has a capacity for handling 1½-in. round stock, 1¼-in. hexagonal stock, and 1 1/16-in. square stock. The maximum length of feed is 8 in. and the maximum milling length 6 in. The range from the turret face to the face of the chucks is from 7 11/16 in. to 13 11/16 in. The diameter of the turret holes is 1½ in. The machine may be equipped for either individual motor or belt drive. Where the individual motor is employed it may be either alternating or direct current, 10 hp. constant speed, running at 1,800 r.p.m. This machine is the product of the Cleveland Automatic Machine Company, Cleveland, Ohio.



Cleveland automatic screw machine well provided to take care of the chips

Journal brass milling machine

An essential job in connection with the maintenance of rolling equipment is the machining of new or second-hand journal brasses. These brasses must be machined accurately or serious trouble is liable to develop in the form of hot boxes caused by uneven bearing pressure. A machine has been patented by S. R. Parslow, 1276 Hague avenue, St. Paul, Minn., essentially for milling journal brasses to conform to the American Railway Association standard dimensions of length and thickness.



Machine for milling journal brasses which automatically clamps the brass in the chuck jaws and feeds it to the cutters

The base and the frame are of heavy cast iron construction. The carrier, which moves vertically to bring the brass against the milling cutter, is provided with four guides with proper adjustment for slack and is properly lubricated. The carrier is operated by an 8-in. air cylinder underneath the frame of the machine. An adjustable screw is provided in the piston rod of this cylinder which provides the correct amount of material to be machined from the brass.

The brasses are held by two pivoted chuck jaws operated by an air cylinder through powerful toggles. Each brass is located by standard lugs. The design of the machine is such that it will not start unless the brass is properly located in the chuck jaws. A safety feature which tends to reduce injury to the work and the machine.

By turning the operating valve, a friction clutch is engaged that starts the milling cutter to revolve and the chuck to close in and down on the brass, holding it securely and centrally with respect to the milling cutter. While this operation is taking place, the chuck carrying the brass is moved upward against the cutter until it reaches the proper thickness, then the operating valve is automatically reversed and the chuck drops back to its loading position.

Three-piece, inserted blade spiral cutters made of high speed steel are used. Some of these cutters have run as long as six months with a single grinding and at

the same time have turned out a desirable quality of work. Owing to the automatic nature of the clamping and operating mechanism, it is claimed that 120 brasses can be finished in an hour. The machine, which is belt-driven from a 3-hp. motor, will take brasses from 2 in. by 7 in. to 6 in. by 11 in.

A ball-bearing spur geared chain block

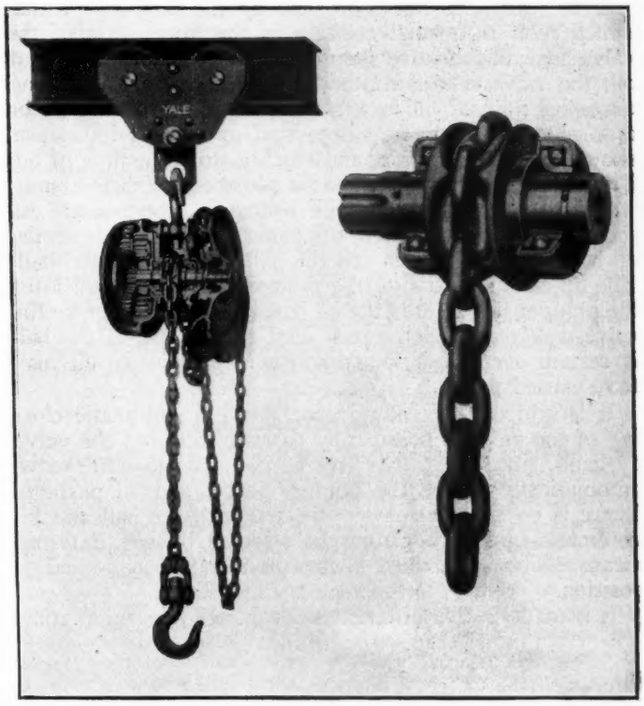
AN interesting development in hoisting equipment has just been placed on the market by the Yale & Towne Manufacturing Company, Stamford, Conn., in the form of a new ball bearing, spur-geared chain block. The design provides for two chrome alloy ball bearings to support the load sheave shaft, arranged so as to take the entire weight of the load and, in addition, to withstand the shock of all thrust and overload surges. The bearings are enclosed in small chambers so designed that by means of steel and felt washers dust and grit is prevented from entering.

The sectional view of the block in the accompanying illustration, shows the location of the massive steel load sheave carried on two ball bearings, each containing vanadium steel balls. The top hook, crosshead, suspension plates, load sheave, electric-welded load chain, detachable shackle, bottom crosshead and hook are all steel, so that the load hangs on a line of steel from hook to hook. It is claimed that the mechanical efficiency of this block has been increased over six per cent by the introduction of ball bearings at the points where they carry the full load.

In order to obviate the danger so common in hoisting, a great deal of attention has been given, not only to the size of the parts in the make-up of the chain block, but to the material entering into these parts. It is considered bad practice to put castings in any part of a chain block where they come in tension. It is considered better practice to use steel forgings, wherever parts come in tension in sustaining the load.

An additional feature is the continuous lubrication of the bearings, driving pinion, shaft and driving gears.

This chain block is made in all capacities from ¼ to 20 tons.



Chain block provided throughout with ball bearings

Insulation for refrigerator cars

A SOMEWHAT unusual development has taken place in the field of refrigerator car insulation, with the advent of what is known as Dry Zero, manufactured by Johns-Manville, New York. This product is the result of intensive study and research work in the theory of heat transmission, in the effort to produce a light and efficient insulation particularly suited for refrigerator cars, where weight is a matter of prime importance.

In arriving at this new product, it was the aim of the manufacturer to find a material in which could be combined to the greatest possible extent, the following essential qualities which are desired by all refrigerator car operators.

The qualities are: the highest possible insulation value; light weight insulant; low moisture absorption; immunity from effects of impact, vibration and torsion; simple and inexpensive application; non-interference with and possible simplification of standard frame construction, and permanence of the insultant and its qualities.

It is claimed that these seven features have been included in the new insulating material. According to tests made by the Bureau of Standards and the Armour Institute of Chicago, Dry Zero insulation has a thermal conductivity of 5.66 B.t.u. per sq. ft. The 2-in. blanket which is principally used for refrigerator car insulation weighs less than 6 oz. a sq. ft. and has a density of 1.57 lb. a cu. ft. It is made up in any size in convenient blanket form, having longitudinal seams spaced 6 in. apart. It can also be used in bulk form—though in this form, it is not so easy to handle. It is claimed further that refrigerator cars insulated with Dry Zero insulation have shown a dead-weight saving ranging from 1,000 to 3,000 lb. on each car.

Dry Zero is a processed vegetable fibre which is hollow in structure, but the ends of each fibre are closed forming a myriad of natural combined air cells. It possesses the peculiar characteristic of being naturally moisture repellent, and also has considerable natural resilience, an inherent quality of the fibre, which counteracts any tendency to settle in a wall. The effects of impact, vibration and torsion are negligible.

On account of its light weight, it can be applied to standard car construction in one course and in one piece extending from the door frame on one side to the door frame on the other side, at the same time effectively insulating the corner posts as well as the other frame members.

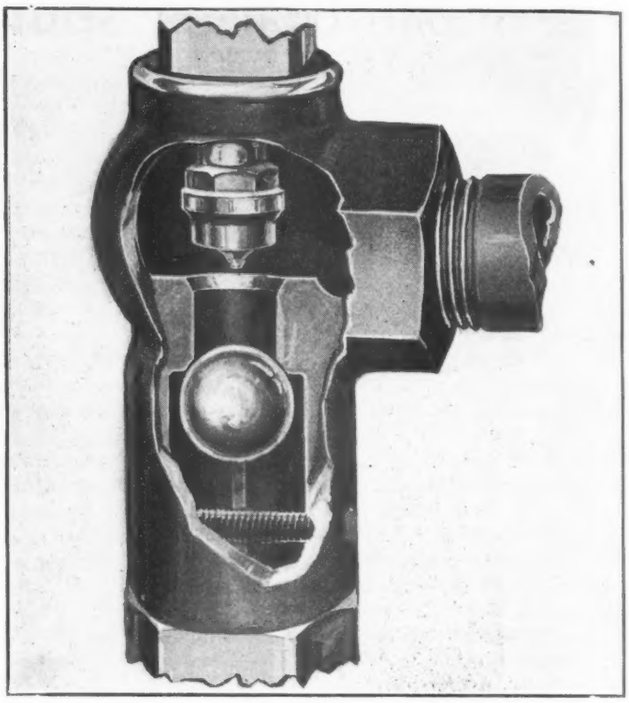
Automatic shut-off valve for oil lines

THE breakage of an oil pipe usually leads to the loss of a considerable quantity of oil before the flow of oil through the break is stopped. The Johnston Manufacturing Company, Minneapolis, Minn., has developed an automatic shut-off valve, the action of which is analogous to that of a fuse in an electric circuit which shuts off the current in case of an excessive flow caused by a short circuit.

This feature is made possible by the action of a ball which rests in normal position in the lower part of the valve beneath the valve stem disk. With a normal flow of oil, the valve acts as a standard angle valve. When an excessive flow of oil occurs because of a broken pipe or any other cause, the ball is carried up against its seat as shown in the illustration, and quickly stops the flow of oil. The valve disk has an extension plunger which is a snug working fit in the oil passage below the valve seat. As soon as this plunger enters the passage, it forces down the oil between the plunger and the ball and releases the ball. The tip on the bottom of the plunger strikes the ball after the plunger has entered the oil passage and just before the valve disk reaches its seat so that the release of the ball is certain even after long service in very dirty oil may have caused wear.

It is said that no interference with the automatic closing of the valve is possible by partially opening the valve by hand, since the ball is free to rise and close the valve automatically before the plunger leaves the oil passage. There is no external part connected with the ball and its automatic operation cannot be affected by any external means. The valve must always be installed in a vertical position.

It is made in five different sizes from ½ in., increasing by ¼ in. increments to 1½ in., with a capacity in gallons per hour of 25, 100, 200, 350 and 800, respectively.

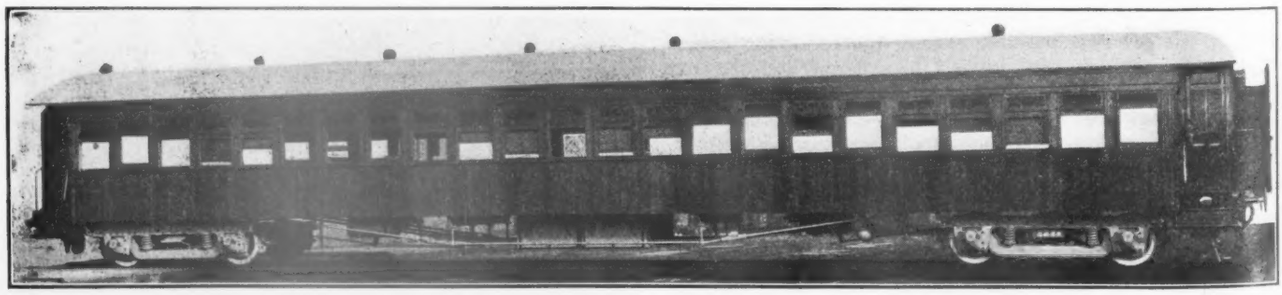


Valve closed by the automatic action of the ball to stop excessive flow of oil

Bearing metal adaptable to many purposes

FRICTION, wear and hot bearings have been the primary factors in retarding the speeding up of machinery. Two factors to be considered in reducing to a minimum these undersirable features are lubrication and bearings. Much attention has been given to the improvement of lubrication and little to the bearing material itself. It is contended that the ultimate source of bearing trouble lies in the material and not in the lubricant. J. E. Loudon & Co., Boston, Mass., conducted a series of experiments on bearing metals and finally developed a metal which is being marketed under the trade name of Mahanite.

An essential characteristic of a good bearing metal is its slow wearing quality. It is claimed for Mahanite that this characteristic has been obtained. Its lasting qualities make it an excellent bearing metal for high speed work. One of its properties is its cushioning effect which absorbs vibration. The metal is porous which provides it with ability to absorb oil, giving it a self-lubricating property. Mahanite may be obtained in the form of solid bars and solid or lined bushings. It may be used for machine and shafting bearing and car and locomotive journals. Grey iron is used for the sleeves of the lined bearings and bushings.



Passenger car built for the Central Argentine railway by the Gloucester Railway Carriage & Wagon Co., Ltd., London, Eng. Length over the buffers, 79 ft. 4 in.; height from rail, 13 ft. 3¾ in.; seating capaity, 138

General News

Edward Dahill, Jr., has been appointed chief engineer of the Freight Container Bureau of the American Railway Association, the new joint A. R. A. committee having decided that Colonel B. W. Dunn, chief inspector of the Bureau of Explosives, should devote his whole time to the explosives bureau. Colonel Dunn has had charge of the container bureau since its establishment. Headquarters, 30 Vesey street, New York City.

The Gulf, Mobile & Northern recently initiated a fuel saving contest for enginemen and firemen which has developed considerable enthusiasm, and promises to result in greatly increased interest in fuel conservation. It is expected that fuel saving records will be broken. The contest extends through the month of April and the winners will be sent at the expense of the company to the annual convention of the International Railway Fuel Association, at Chicago on May 26.

The Chicago Milwaukee & St. Paul during 1924 effected an excellent record in the conservation of fuel. In freight service the pounds of coal consumed per 1,000 gross ton-miles were reduced from 194.4 lb. in 1920 to 167.8 lb. in 1924. The consumption of coal per passenger car-mile in passenger service was reduced from 20.1 lb. in 1920 to 17.5 lb. in 1924. This saving in the use of coal amounted to 509,000 tons for the year, applied to the volume of business handled in 1924, and the saving in money, at the average price of coal in 1924, was $1,473,454.

The western roads have continued to sign agreements with the engineers and firemen on the basis of the Southern Pacific settlement, granting wage increases of approximately six per cent without important changes in working rules. A total of 46 western roads have now signed agreements. The latest roads include the Chicago, Milwaukee & St. Paul; the Atchison, Topeka & Santa Fe; the Duluth & Iron Range; the East St. Louis Junction; the Minneapolis & St. Louis; the Missouri-Kansas-Texas; the Northwestern Pacific; the Quincy, Omaha & Kansas City; the Texas & Pacific; the Union Railway of Memphis; the Oregon-Washington R. R. & Navigation Company; the Mississippi River & Bonne Terre; the Union Stock Yards of Omaha; the Chicago, Rock Island & Pacific; the Chicago, Rock Island & Gulf, and the Sioux City Terminal.

Locomotive Inspection Bureau's March report

The Bureau of Locomotive Inspection of the Interstate Commerce Commission in March inspected 6,676 locomotives, of which 3,007, or 45 per cent, were found defective, and 331 were ordered out of service, according to the commission's monthly report to the President on the condition of railroad equipment. The Bureau of Safety during the month inspected 110,475 freight cars, of which 3,696 were found defective, and 2,003 passenger cars, of which 26 were found defective. During March eleven cases, involving 14 violations of the safety appliance acts, were transmitted to various United States attorneys for prosecution.

Enola sets up a mile-stone

The shop of the Pennsylvania Railroad at Enola, Pa., opened on July 25, 1923, for the repair of the steel cars of the company, has lately completed work on the ten thousandth car, and the job was celebrated by having a photograph taken of J. W. Priest and his gang of 43 men, who did the work on this car. The total number of men employed in this shop at present is 833, of whom 419 own shares in the railroad company's stock. For the repair of steel cars there are three runways, on each of which there are three gangs of 43 men each; and two tricks are worked, thus employing 18 gangs in all. The daily output of this shop is from 37 to 40 cars. Repairing and rebuilding is done here for all parts of the Pennsylvania System.

Wage statistics for January

In January, 1925, the number of employees reported by Class I railroads was 1,728,333 a decrease of 8,366 or 0.5 per cent, as compared with the previous month, according to the Interstate Commerce Commission's monthly bulletin of wage statistics. The total compensation increased $3,011,216 or 1.3 per cent. Compared with the returns for January, 1924, the employment shows a decrease of 1.2 per cent and the total compensation an increase of 1.6 per cent. The most substantial change in straight time hourly earnings appears for the train and engine service employees, whose average straight time earnings per hour increased from 73.8 cents to 77.5 cents. For all employees reported on an hourly basis, the average straight time earnings per hour were 57.6 cents in January, 1924, and 58.8 cents in January, 1925.

Electric operation will be started on the Detroit & Ironton about June 1

First tests of the Detroit & Ironton locomotives will take place on a section of track just outside the River Rouge Ford plant at Detroit, Mich., about June 1. Foundations for trolley-support arches have been laid along three miles of this double-track line. Concrete parts for the trolley supports are being cast. Power for operating the road will be developed at 13,200 volts, 60-cycles, 3-phase alternating current. A frequency changer substation to be built near the power house will convert this energy to 22,000-volts, single-phase, 25-cycle alternating current power for use on

Freight cars installed and retired

Month—1924	Installed during month	Aggregate capacity tons	Retired during month	Aggregate capacity tons	Owned at end of month	Aggregate capacity tons	Building in R. R. shops
January	15,589	707,367	12,329	516,695	2,310,032	100,644,107	2,417
February	11,386	554,481	10,466	411,228	2,310,570	100,767,731	2,715
March	9,962	446,094	8,726	352,481	2,311,405	101,165,332	2,697
April	8,718	369,978	8,026	306,288	2,312,074	101,223,891	2,739
May	9,199	439,516	9,059	360,212	2,312,237	101,303,200	2,467
June	10,909	538,118	8,347	321,094	2,314,798	101,569,593	2,269
July	16,583	1,151,302	8,413	316,927	2,322,968	102,388,652	4,602
August	15,452	785,288	8,834	333,173	2,329,582	102,845,000	3,618
September	15,455	779,078	9,337	370,607	2,336,147	103,270,000	3,045
October	16,598	834,762	10,504	*418,816	2,342,149	103,688,000	*3,574
November	11,705	579,234	10,678	463,970	2,342,479	103,767,000	5,159
December	6,763	311,254	11,918	488,035	2,337,229	103,585,000	6,478
January, 1925	11,768	551,263	7,867	326,812	2,341,109	103,812,974	5,285
February	.....	.....	.....	.....	.....	.....	....
Total for 2 months	.....	.....	.....	.....	.....	.....	....

*Corrected figures.

Figures as to installations and retirements prepared by Car Service Division, A. R. A. Figures cover only those roads reporting to the Car Service Division. Figures of installations and retirements alike include equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

the trolley. The track and trolley are expected to be in condition for tests about June 1.

Three of the four sections of the first locomotive have been practically completed. The main wiring on the first section has been completed and the control wire is being installed. The main wiring has also been partially completed on the second and third sections. Flexible armored cable is being used for all main circuit connections. This is a wiring feature which has probably never before been used in an electric locomotive. All of the main direct current leads are covered with steel armor, while the alternating current leads are covered with brass armor. It is expected that the locomotive will be completed and ready for tests some time during April.

New equipment for South Africa

The Times (London) Trade Supplement summarizes the report of the general manager of the South African Railways for the fiscal year ended March 31, 1924, in part, as follows:

A number of locally constructed rail-motor vehicles of the converted road-omnibus type have been introduced, and with the object of gaining practical experience of types of rail motor-coaches in use in other countries orders were placed for a 68 hp. Service car to seat 38 passengers and for a Sentinel-Cammell steam-coach to seat 40. Experiments have also been made with a tractor coach equipped with a 120 hp. producer-gas engine and electric transmission. The fuel used for gas production is the char removed from steam locomotive smoke-boxes. The tractor has been in use between Kimberley and Winters Rush, hauling a composite passenger coach, and the results of the experiment have warranted the ordering of a 500 hp. producer-gas tractor.

A number of cars have been converted to form a train to be used for purposes of agricultural demonstration. In addition to a coach and dining car for the technical and supervisory staff, the train contains 12 cars equipped for the demonstration of various forms of agricultural activity.

Twelve dining cars of the new "twin" type were being built in South Africa. They are 60 ft. long and operate in pairs, each pair comprising a restaurant car with 46 seats and another containing pantry, kitchen, and sleeping accommodation for the staff.

Maintenance of doors, door fixtures, etc., on freight car equipment

Circular No. D. V.-393 has recently been issued by the Mechanical Division of the A. R. A. calling attention to the lack of maintenance of side doors, end doors, roof doors and hatch covers, door fixtures, tracks, guides, brackets, stops and sealing devices on house car equipment.

This lack of maintenance has resulted in a large number of claims for damage to lading by the elements, the pilfering of lading occasioned by easy access to cars, as well as the resultant loss of doors and liability by accidents. In many cases doors found off the track have been rehung simply by forcing them into place without making necessary repairs to the loose or otherwise defective parts which permitted the door to become displaced. Complete repairs of a permanent and substantial character should be made to cars, either owned or foreign, when found with defective door fixtures or sealing devices. Under no conditions should cars having defective doors, fixtures or sealing devices, be loaded.

Attention is further directed to the necessity of car owners adopting standards for maintenance that will insure doors and hatch covers on house car equipment being of such design as will prevent their readily becoming defective or losing off in ordinary service.

It is requested, therefore, that car owners inaugurate an intensive campaign at all repair points, freight houses and loading stations, to the end that a decided improvement may be effected, in order to avoid necessity for the establishment of a rule which would allow refusal of such defective cars when offered in interchange under load.

Court News

Engineers qualified experts as to power of air pumps.—The West Virginia Supreme Court of Appeals holds that locomotive engineers with from 10 to 15 years' experience in operating engines were qualified to testify as to whether or not one air pump was sufficient to control a heavy train.—Lambert v. Virginia Ry. Co. (W. Va.), 122 S. E. 457.

Movement of engine without headlight violation of boiler inspection act.—The Kentucky Court of Appeals holds that the movement of a locomotive without a headlight was a violation of the Boiler Inspection Act and the proximate cause of the death of a brakeman thrown from a cut of cars as the result of a collision.—Callihan's Admr. v. C. & O. (Ky.) 263 S. W. 339.

Return of defective car not violation of law.—A terminal company receiving cars for transfer between other roads received a car with a defective running board, marked it for return as in bad order, and retained it until a string of cars for the company sending it had accumulated, when it was returned. The Circuit Court of Appeals, Sixth Circuit, holds that such retention and return were not a violation of the Safety Appliance Act.—U. S. v. Louisville & J., 1 Fed. (2nd) 646.

Safety appliance act provision as to grab-irons does not apply to top of tender.—Judgment was obtained in an action in the Georgia state courts by a baggageman injured while assisting in coaling the engine of his train, by being thrown from the tender while climbing down the ladder, by a sudden jerk of the train. The case was brought to the United States Supreme Court on certiorari. Negligence in operating the train was charged, and also omission to equip the locomotive with the appliances required by law, the top of the ladder not reaching over the top of the flange at the rear of the tender, so that a person climbing down the ladder had no handhold except the sheet-iron flange. This was alleged to be a violation of Sec. 2 of the Safety Appliance Act, which provides that: "All cars requiring secure ladders and secure running boards shall be equipped with such ladders and running boards, and all cars having ladders shall also be equipped with secure handholds or grab-irons on their roofs at the tops of such ladders."

The trial court charged the jury that the grab-iron provision

Freight car repair situation

1924	Number freight cars on line	Cars awaiting repairs: Heavy	Light	Total	Per cent of cars awaiting repairs	Month	Cars repaired: Heavy	Light	Total
January 1	2,279,363	118,653	39,522	158,175	6.9	December	87,758	2,073,280	2,161,038
April 1	2,274,750	125,932	46,815	172,747	7.6	March	77,365	2,213,158	2,290,523
July 1	2,279,826	144,912	49,957	194,869	8.5	June	70,480	1,888,899	1,959,379
October 1	2,304,020	157,455	48,589	206,044	8.9	September	74,295	1,372,277	1,446,572
January 1, 1925	2,293,487	143,962	47,017	190,979	8.3	December	66,615	1,288,635	1,355,250
February 1	2,305,520	139,056	47,483	186,539	8.1	January, 1925	69,084	1,358,308	1,427,392
March 1	2,313,092	141,192	43,855	185,047	8.0	February	66,283	1,313,088	1,379,371

Data from Car Service Division Reports.

Locomotive repair situation

Date, 1924	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
February 1	64,377	53,586	4,116	5,919	9.2	4,872	7.6	10,791	16.8
April 1	64,363	52,805	4,648	6,128	9.5	5,430	8.4	11,558	17.9
July 1	64,416	53,382	7,117	6,035	9.4	4,999	7.7	11,034	17.1
October 1	64,538	53,209	5,424	6,175	9.6	5,154	8.0	11,329	17.6
January 1, 1925	64,384	53,118	4,849	5,927	9.2	5,339	8.3	11,266	17.5
February 1	64,308	52,994	4,220	6,143	9.6	5,171	8.0	11,314	17.6
March 1	64,255	52,851	4,988	6,217	9.7	5,187	8.0	11,404	17.7

Data from Car Service Division reports.

applied to a locomotive tender though it had no roof. Exception was taken.

The United States Supreme Court holds that the trial court erred in its charge on the effect of the statute, and the judgment of the Georgia Court of Appeals affirming judgment for the plaintiff was reversed and a new trial granted.

The Supreme Court said: "The word 'roofs' is the determining one. The Interstate Commerce Commission is empowered to designate the number, dimensions, location, and manner of application of the appliances provided for by Sec. 2. The commission's regulation as to ladders on tenders requires a suitable metal end or side ladder fastened with bolts or rivets. The omission to require a grab-iron is a practical construction by the commission. While the view of the commission is not conclusive with us, it is properly persuasive. We agree with it."—Davis v. Manry. Decided January 5, 1925. Opinion by Mr. Justice McKenna.

Meetings and Conventions

L. F. Loree to address Fuel Association convention

The International Railway Fuel Association has arranged an exceptional program for its seventeenth annual convention to be held at the Hotel Sherman, Chicago, May 26, 27, 28, 29. L. F. Loree, president of the Delaware & Hudson, J. D. Battle, traffic manager, National Coal Association, and President P. E. Bast, fuel engineer, Delaware & Hudson, are scheduled to make the opening addresses.

Wednesday, May 27, is known as "Operating Day" and the subjects to be discussed relate principally to the functions of the stores and operating departments. The program includes a paper by H. C. Pearce, director of purchases and stores, Chesapeake & Ohio; Mark Kuehn, chairman fuel committee, National Association of Purchasing Agents and G. M. Basford. Thursday, May 28, is to be known as "Mechanical Day" and the program includes papers by John Purcell, assistant to the vice-president, Atchison, Topeka & Santa Fe; and C. B. Smith, mechanical engineer, Boston & Maine. On the last day of the convention, J. W. Clark, chief fuel supervisor, Southern Pacific, is scheduled to read a paper on oil burning. The program is as follows:

TUESDAY, MAY 26

9:30 a.m.—(Daylight saving time). Opening addresses by J. D. Battle, traffic manager, National Coal Association. L. F. Loree, president, Delaware & Hudson. P. E. Bast (president), fuel engineer, Delaware & Hudson.
11:30 am.—Adjournment.
2:00 p.m.—Report of secretary-treasurer.
2:10 p.m.—Appointment of Auditing and other Special Committees.
2:20 p.m.—Unfinished business.
2:30 p.m.—New business.
2:40 p.m.—Report of Standing Committee on Fuel Stations.
3:30 p.m.—Report of Standing Committee on Fuel Accounting, Distribution and Statistics.
4:30 p.m.—Signals and the Saving of Fuel, B. J. Schwendt, superintendent of signals, New York Central Lines.
5:30 p.m.—Adjournment.

WEDNESDAY, MAY 27 (OPERATING DAY)

9:00 a.m.—How Can Fuel Purchases Affect Economy? H. C. Pearce, director of purchases and stores, Chesapeake & Ohio.
9:45 a.m.—Stocks, Consumption, and Production of Coal, Mark Kuehn, chairman, Fuel Committee, National Association of Purchasing Agents.
10:30 a.m.—Report of Standing Committee on Diesel Locomotives.
12:00 m. —Topical discussion, Effect on Fuel Consumption of Recent Developments in Operating Practice.
12:45 p.m.—Adjournment.
2:00 p.m.—Report of Standing Committee on Firing Practice (Oil section).
3:45 p.m.—Report of Standing Committee on Firing Practice (Coal section).
5:30 p.m.—Adjournment.

THURSDAY, MAY 28 (MECHANICAL DAY)

9:00 a.m.—How Can a Mechanical officer Affect Fuel Economy? John Purcell, assistant to vice-president, Atchison, Topeka & Santa Fe.
9:30 a.m.—Report of Standing Committee on Feedwater Heaters.
11:00 a.m.—Report of Standing Committee on Front Ends, Grates and Ash Pans.
12:00 m. —Topical discussion.
12:45 p.m.—Adjournment.
2:00 p.m.—Report of Standing Committee on Stationary Plants.
3:00 p.m.—Mechanical Means for Cleaning Locomotive Flues, C. B. Smith, mechanical engineer, Boston & Maine.
3:45 p.m.—Fundamental Fuel Factors, G. M. Basford.
4:45 p.m.—Report of Auditing and other special committees.
5:30 p.m —Adjournment.

FRIDAY, MAY 29

9:00 a.m.—The Development of Oil Burning Practices on Locomotives, J. N. Clark, chief fuel supervisor, Southern Pacific Company.
10:00 a.m.—Report of Committee on Tanks.
10:15 a.m.—Report of Standing Committee on Constitution and By-Laws.
10:30 a.m.—Election of officers.
11:00 a.m.—Balloting for place of 1926 meeting.
11:30 a.m.—Convention adjournment.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next meeting May 26-29, inclusive, Alexandria Hotel, Los Angeles, Cal.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Business meeting to be held in Chicago June 16, 17 and 18. No exhibit of railway supplies and machinery will be held.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting September, 1925.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Next meeting May 19, 20 and 21, at St. Louis, Mo.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention August, 1925, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division. A. F. Steubing, Bradford Corp., 25 West Forty-third street, New York. Spring meeting May 18 to 21, inclusive, Milwaukee, Wis.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Annual convention week of September 14, 1925, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, June 22-26, Chalfonte-Haddon Hall, Atlantic City, N. J..

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting October 20-24, Hotel Sherman, Chicago.

CANADIAN RAILWAY CLUB.—C. K. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings second Thursday each month, Hotel Statler, Buffalo, N. Y. Next regular meeting May 14. Paper on The New Locomotive will be read by W. H. Winterrowd, assistant to president, Lima Locomotive Works. Next interim meeting, June 11. Paper on Meeting Personnel will be presented by John G. Walber, vice-president in charge of personnel, New York Central. Young men's night.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November. Next meeting May 12. No paper will be read, but a musical entertainment will be given by Doc. Howard's Cuvier entertainers. Dinner party and smoker.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland, Public Square, Cleveland. Next meeting May 4. Paper on Train Resistance and Tonnage Rating will be read by F. E. Sellman, Master mechanic, Pennsylvania Lines.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next convention, Hotel Winton, Cleveland, Ohio, August 18, 19 and 20.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 6000 Michigan Ave., Chicago, Ill. Next annual convention May 26-29, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha Ave., Winona, Minn. Annual convention September 8-11, Hotel Sherman, Chicago.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y. Next convention May 19-25, Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass. Next meeting May 12. Annual banquet and entertainment.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Next meeting, Friday, May 15, 1925, at the Biltmore Hotel. Address by R. E. Woodruff, Erie Railroad, Buffalo, N. Y., on "Lubricating a railroad organization."

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Next meeting, Thursday, May 14, 1925.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings second Friday in each month, except June, July and August. Next meeting May 8. Paper on Clay Products will be presented by J. C. Iselin, traffic manager, Blackman-Post. Moving picture showing development of clay industry.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting September 15-18, 1925, Chicago.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Annual dinner May 23, Edgewater Beach Hotel, Chicago.

Supply Trade Notes

The Standard Stoker Company, Inc., has removed its New York City office from 5054 Grand Central Terminal to 350 Madison avenue.

The Midwest Forging Company, Chicago Heights, Ill., has moved its principal business office to 38 South Dearborn street, Chicago.

The Harnischfeger Corporation, Milwaukee, Wis., has appointed A. M. Lockett & Co., New Orleans, La., its agent in Louisiana and Mississippi.

Robert H. Blackall, 7 East Forty-second street, New York, has arranged for the rights to sell the Lawson pipe wrench in the United States.

A. H. Beale, president of the Lebanon Iron Company, Lebanon, Pa., has resigned to become president of the A. M. Byers Company, Pittsburgh, Pa.

The Whiting Corporation, Harvey, Ill., has opened a sales room at 997 Ellicott Square, Buffalo, N. Y., and has appointed W. R. Hans district manager.

The McGill Manufacturing Company, Valparaiso, Ind., has appointed the J. G. Pomeroy Company, San Francisco, Cal., its Pacific coast representative.

The Elvin Mechanical Stoker Company has removed its executive offices from 50 Church street to the third floor of 30 Church street, New York City.

E. H. Batchelder, Jr., Lytton building, Chicago, has been appointed western railroad representative of the varnish and enamel division of the Beaver Products Company.

The Kilby Car & Foundry Company, Anniston, Ala., has opened an office at 2038 Grand Central Terminal, New York, in charge of J. N. Brownrigg and Fred MacDonald.

The U. S. Light & Heat Corporation has removed its New York district office from the Grand Central Terminal to 161 West Sixty-fourth street, New York City.

Walter Bentley of the advertising department of the Railway Journal has been appointed sales manager of the Waugh Equipment Company, with headquarters in Chicago.

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, has opened a new office at 203 East Fifteenth street, New York, in charge of L. Wechsler, sales representative.

Alfred W. Lockwood has joined the sales organization of the Bridgeport Brass Company, Bridgeport, Conn., as a special representative, operating out of its New York office.

William H. Keller, Inc., has removed its office from 50 Church street, New York, to 50 Dey street, where a complete line of pneumatic tools and repair parts will be carried.

W. W. Glosser has been appointed general sales manager of the Verona Tool Works, Pittsburgh, Pa., and Frank B. Nimmo has been appointed assistant general sales manager.

The quick change speed sensitive drilling machine business of the Sipp Machine Company, Paterson, N. J., has recently been purchased by the Foote-Burt Company, Cleveland, Ohio.

The Gould Coupler Company and the Gould Storage Battery Company, Inc., have removed their offices from 30 East Forty-second street to 250 Park avenue, New York City.

J. C. Davis, of the sales department of the Ohio Injector Company, with headquarters at Wadsworth, Ohio, has been promoted to assistant sales manager, with the same headquarters.

Fred C. Schreiber, representative of the Stocker-Rumely-Wachs Company, has resigned to become sales representative of Manning, Maxwell & Moore, Inc., with headquarters in Chicago.

M. B. MacNeille, chief engineer of the hydraulic department of Fairbanks, Morse & Co., with headquarters in Three Rivers, Mich., has been promoted to manager of the pump division.

The Globe Steel Tube Company, Milwaukee, Wis., has opened a district sales office at 444 Frisco building, St. Louis, Mo., and has appointed E. C. Carroll manager of sales for that district.

The Ohio Locomotive Crane Company, Bucyrus, Ohio, has placed Arnold Walters, district sales manager, in charge of a newly opened district office at 647 Book building, Detroit, Mich.

The Whiting Corporation, Harvey, Ill., has removed its Chicago district sales office from 945 Monadnock block to 1502 Railway Exchange. R. S. Hammond is district sales manager.

The Kansas City Bolt & Nut Company will construct a one-story plant 90 ft. by 240 ft. in Kansas City, Mo., at an estimated cost of $23,000. A branch office has been opened at Tulsa, Okla.

The Elwell-Parker Electric Company, Cleveland, Ohio, has appointed J. P. Lyons, 612 Citizens and Southern Bank building, Atlanta, Ga., its district engineer for the territory contiguous to Atlanta.

At the recent annual meeting of the stockholders of the Yale & Towne Manufacturing Company, Stamford, Conn., the eight directors in office were unanimously continued as such, Vice-President Schuyler Merritt being elected chairman of the board and Gabriel S. Brown, a director to fill the vacancy caused by the death of Henry R. Towne. Addison Boren, assistant to the president and controller, was elected treasurer, succeeding J. H. Towne, who still retains the office of secretary. Mr. Towne's relinquishment of the treasurership was due to increasing encroachment on his time by other matters. Mr. Merritt, the newly elected chairman of the board, entered the Yale service in 1877 as an office assistant. In 1878 he was elected a director and at the same time secretary of the company. He served as treasurer from 1898 to 1902 and since then as a director. Educated for the law, he has always had charge of the company's legal affairs and also of its patent interests. During recent years he has given special attention to the business of the bank lock department. He is also chairman of the board of directors of the First-Stamford National Bank, and has represented the Fourth Congressional District of Connecticut in Congress since 1917. Mr. Boren, who has been elected treasurer, came to the service about seven years ago as manager of the Works Accounting Bureau. After completing his education he became associated with the Best Manufacturing Company of Pittsburgh, with whom he remained for 15 years. He then engaged in the public accountant business until his removal to Stamford to take up tasks with Yale & Towne. Mr. Boren served successively as chief accountant, controller, assistant to the president and finally treasurer. He is a director of the National Association of Cost Accountants and a certified public accountant of Connecticut.

Schuyler Merritt

W. H. East, assistant electrical engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, has resigned to become railway sales engineer of the Central Electric Company, Chicago.

Benjamin Nields, Jr., sales agent for the National Malleable & Steel Castings Company, Cleveland, Ohio, has removed his office from 30 Church street to 17 East Forty-second street, New York City.

The Harnischfeger Corporation, Milwaukee, Wis., has removed its Pittsburgh, Pa., sales office from the Fidelity building to 612 Farmers Bank Building, Fifth avenue and Wood street. A. J. Dreyer is district manager and M. B. Bradley is sales engineer at this office.

The Minwax Company, Inc., has removed its office from 18 East Forty-first street to 270 Madison avenue, New York City.

Its Chicago district office has been removed to 10 East Huron street, Chicago.

E. S. Jackman & Co., agents of the Firth-Sterling Steel Company, have removed from 333 Frankfort avenue, Cleveland, Ohio, to their new warehouse and office at 1424 East Twenty-fifth street, N. E. Cleveland.

Arthur E. Bendelari, who has been in charge of operations in Missouri and Oklahoma for the Eagle-Picher Lead Company, has been appointed vice-president and treasurer to succeed Thomas R. Brown, Jr., retired.

J. B. Murphy, district sales manager for the Minneapolis territory of J. D. Wallace & Co., manufacturers of woodworking machinery, has been promoted to assistant sales manager, with headquarters in Chicago.

The Truscon Steel Company, Youngstown, Ohio, will erect two warehouses in Buffalo, N. Y., on a piece of land 400 ft. by 150 ft., at Bailey avenue and William street. One will be erected at once and the other in the fall.

C. A. Ilgenfritz, assistant purchasing agent of the Youngstown Sheet & Tube Company, has been appointed purchasing agent of the United Alloy Steel Corporation, Canton, Ohio, to succeed George W. Starr, resigned.

Joseph M. Welles has been appointed resident representative of the Standard Coupler Company, New York. Mr. Welles will have his headquarters in the Peoples Gas building, Chicago. He succeeds W. Eckels, resigned.

W. Sharon Humes, sales representative of the Magnus Company, Inc., with headquarters in Chicago, has resigned to become sales representative of the Central Brake Shoe & Foundry Company, with headquarters in Chicago.

H. G. Von Nostrand of the sales department of the Illinois Steel Company, Chicago, and formerly manager of tie-plate sales of the Railroad Supply Company, Chicago, died on March 19 following an illness of six weeks.

The Master Tool Company, Cleveland, Ohio, reclaimers of pneumatic tools, has appointed M. W. Scott, eastern representative, with headquarters in Pittsburgh, Pa., and A. B. Stewart & Co., Chicago, western representative.

The Davis Equipment Company and M. E. Davis, dealers in railroad and construction equipment have removed their offices from 50 Church street to 8 West Fortieth street, New York City.

Matt J. Herold, formerly in charge of sales in the East Central division of the Wood-Imes Manufacturing Company, has resigned to become general sales manager of the United States Electrical Tool Company, Cincinnati, Ohio.

S. G. Down, vice-president of the Westinghouse Air Brake Company, Wilmerding, Pa., has been elected also a member of the board of directors, filling a vacancy on the board created by the death of Morris Rosenwald.

G. W. Brogan, Inc., Towson, Md., is now acting as merchandising counsel and handling the advertising of the Bonney Forge & Tool Works, Allentown, Pa., manufacturers of drop forged wrenches and of the chrome vanadium wrench.

Paul T. Farrell of the purchasing department of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has been promoted to assistant purchasing agent to succeed C. A. Ilgenfritz, resigned to accept a position with another company.

The Mid-West Forging Company, Chicago, is enlarging its works at Chicago Heights, Ill., by the addition of a steel building 50 by 120 ft. for manufacturing purposes, a steel building 40 by 70 ft. for steel storage and a warehouse 40 by 120 ft.

A building used for the storage of pattern and flash lumber at the Berwick, Pa., plant of the American Car & Foundry Company was totally destroyed by fire on February 27, entailing a loss of from $400,000 to $500,000. The loss will not delay production.

William C. Wolfe has been appointed district sales manager, welded and weldless division of the American Chain Company, Inc., Bridgeport, Conn. Mr. Wolfe's headquarters are at 208 South La Salle street, Chicago. He succeeds George C. Isbester, resigned.

The Houston Car Wheel & Machine Company, Houston, Tex., is preparing plans for extensions, including a one-story building 75 ft. by 200 ft., the installation of an electric furnace, electric traveling cranes, heavy duty machine tools and auxiliary equipment.

The Railway Car Forging Company, Chicago, has been incorporated to manufacture iron and steel forgings, pressed steel parts and other metal products for car equipment. The company has taken over the Chicago Heights, Ill., plant of the Illinois Car & Manufacturing Company.

The Firth-Sterling Steel Company, E. S. Jackman & Co., agents, has moved its Los Angeles, Cal., office from 336 East Third street to larger quarters at 2154 Santa Fe avenue, Los Angeles. William Ely Nelson, who has been with the company almost 25 years, is Pacific coast representative.

The G. A. Gray Company is constructing a new shop and office building at Evanston (Cincinnati), Ohio. The shop is to be a steel frame building, 420 ft. by 210 ft., with walls of steel sash and glass. The office will be a two-story brick building, located at the eastern end of the shop.

Howard Longstreth, secretary of the Lebanon Iron Company, Lebanon, Pa., has been elected president to succeed A. H. Beale, who has resigned to accept service with another company. H. W. Pratt has been appointed secretary-treasurer and J. J. McDermott has been appointed assistant treasurer.

The Morton Manufacturing Company, Chicago, has appointed the Crowe-Matthews Company, 212 Douglas building, Seattle, Wash., and 1177 Dock street, Tacoma, Wash., its exclusive and direct representative covering the sale of Acme line of railway appliances in the northwestern section of the United States.

The Walworth Manufacturing Company, Boston, Mass., recently formed an engineering products division to co-operate with the engineering production and sales departments of the company. John M. Olmsted has been appointed general manager of the division, with headquarters in Chicago and Fred W. Duemler, assistant manager at New York.

Lyle Marshall, former manager of the service department of the Industrial Works, Bay City, Mich., and later connected with the Chicago office, has been promoted to district sales manager in the newly opened office at 619 Dixie Terminal building, Cincinnati, Ohio. James E. Shearer, assistant sales manager, Bay City, Mich., has been transferred to New York.

Andrew C. Duncan, 2835 Washington Boulevard, St. Louis, Mo., has been appointed district engineer for the Elwell-Parker Electric Company, Cleveland, Ohio, for the territory contiguous to St. Louis. George C. Hays has been appointed district engineer of the territory contiguous to Indianapolis, Ind. Mr. Hays' headquarters are 225 Indiana Terminal Warehouse building, Indianapolis.

The Bird-Archer Company, New York, is now conducting its Canadian business entirely from a general office at 300 McGill building, Montreal, Que. Previously the Canadian business has been conducted from the head offices at New York; the Canadian factory and laboratory will be located at Cobourg, Ont. Hugh C. Harragin is in charge of the administration of the Canadian business with head offices at Montreal.

The Electric Storage Battery Company, Philadelphia, Pa., has bought land as a site for a factory branch to be built in Boston, Mass., on Ashford street, near Babcock. The new building will cover about 35,000 sq. ft., and will consist of a two-story office fronting on Ashford street, with a one-story manufacturing establishment in the rear. It will be of modern daylight construction and the equipment will be modern in every respect.

Harry B. Gilmore, for the past 17 years manager of the distributing organization of the Western Electric Company, at Boston, Mass., has been elected secretary of the company. A few months ago he was made assistant secretary and was transferred to New York. He succeeds as secretary George C. Pratt who in the future will devote his entire time to his duties as general attorney. Donald S. Pratt was elected an assistant secretary to Mr. Gilmore.

C. M. Robertson, vice-president in charge of Chicago sales of the Consolidated Machine Tool Company, has resigned to become sales engineer of the Orton & Steinbrenner Company. From 1901

to 1908 he was superintendent of the Colburn Machine Tool Company, Cleveland, and from the latter date until 1918 he was manager of the Chicago territory of the Essley Machine Tool Company. From 1918 until his recent promotion he was vice-president in charge of the Chicago sales of the Consolidated Machine Tool Company.

The Linde Air Products Company, New York, manufacturer and distributor of oxygen for welding and cutting, has opened the following new district sales offices: In the First National Soo Line building, Minneapolis, Minn., C. E. Donegan, district sales manager; Lincoln Life building, Birmingham, Ala., W. A. K. Popp, district sales manager, and in the Exchange National Bank building, Tulsa, Okla., G. D. Grubb, district sales manager. J. W. Foster, senior salesman in the Pittsburgh Linde district, has been appointed district sales manager at Baltimore, Md.

The Gold Car Heating & Lighting Company, New York, will be temporarily represented in the Chicago territory by F. O. Bailey, manager of sales, and A. D. Stuyer with address the same as heretofore. W. G. Willcoxson is no longer connected with the company. W. H. Ivers, who has again become associated with the company, will be located at St. Louis, Mo., and will represent the territory formerly represented by W. J. Roehl. Tom Moore has been appointed representative in charge of the southern territory, with headquarters in the Royster building, Norfolk, Va. Mr. Moore was formerly purchasing agent of the Virginian Railway.

Farrand P. Hall has been appointed district sales manager of the Carborundum Company in charge of the sales organization and branch warehouse at Cleveland, Ohio, succeeding John MacArthur, who has been assigned to special sales service work at Niagara Falls, N. Y. Mr. Hall joined the Carborundum sales force in 1914 as a salesman, covering the territory in and about Montreal and the Maritime provinces. From 1916 to 1922 he was engaged in the retail hardware business, returning to the Carborundum Company in 1922. Mr. MacArthur has been a member of the sales force since 1909. He was appointed district sales manager at Cleveland in January, 1919.

O'Neill Ryan, Jr., has been appointed advertising manager of the Celotex Company, Chicago, to succeed M. F. Harris, resigned. W. L. Bryson, formerly district manager of the Beaver Products Company, Kansas City, Mo., has been appointed manager of the St. Louis division, with headquarters at St. Louis, Mo. The Celotex Company has granted a license for the manufacture of its product in Australia to a new company which is now being organized by H. C. Armstrong, Sydney, Australia, in conjunction with Crawford Vaughan, ex-premier of South Australia. This company will erect a mill at a cost of approximately $650,000 which will have a yearly capacity of 30,000,000 ft.

R. P. Townsend has been appointed eastern assistant manager of the railroad department of Johns-Manville, Inc., with headquarters at New York. Mr. Townsend entered the service of the New York Central in November, 1906, after having graduated from Walworth Institute. He resigned in July, 1917, to become purchasing agent and later assistant to vice-president of the Liberty Steel Products Company, which later changed its name to the American Railway Appliances Company. Mr. Townsend resigned from that company in March, 1924, to enter the railroad department of the Murphy Varnish Company, which position he held until his new connection with Johns-Manville, Inc.

The Oneida Manufacturing Company, Green Bay, Wis., has been acquired by the Railway Motors Corporation, Railway Exchange building, Chicago, which has been incorporated under the laws of Delaware with a capital of $1,000,000. Officers of the new company will be, president, L. W. Melcher, president and general manager of the Oneida Manufacturing Company; R. E. Frame, treasurer of the Central Brake Shoe & Foundry Company, Chicago; A. C. Deverall, formerly general superintendent of motive power of the great Northern; A. A. Aggerbeck, Chicago; J. H. Taylor, president of the McCartney National Bank, Green Bay, Wis. The Green Bay plant will be used to manufacture power units. Other plants will be established in various districts.

Ralph C. Davison, engineer of the American Abrasive Metals Company, New York, died of pneumonia on April 15 at his home in Plainfield, N. J., at the age of 50. Mr. Davison was educated at Stevens Institute. He became associated with the American Abrasive Metals Company in January, 1918, and previously had served for about ten years with the American Mason Safety Tread Company, New York, in a selling and engineering capacity and as a director. He had also been connected with the Concrete Association of America, and at one time was an associate editor of the Railroad Gazette. Mr. Davison was a member of the American Society of Mechanical Engineers, the American Society of Safety Engineers and the New York Railroad Club.

The extensive patent litigation which has been going on since 1911 between The Safety Car Heating & Lighting Company and the U. S. Light & Heat Corporation, and its predecessor, The United States Light & Heating Company, recently resulted in a judgment against the U. S. Light & Heat Corporation for over $500,000. The parties have agreed to settle this judgment by the sale to The Safety Car Heating & Lighting Company by the U. S. Light & Heat Corporation of all of its patents, machinery, equipment and inventory used in, or connected with car lighting. This sale does not include USL arc welders or the USL batteries. U. S. Light & Heat Corporation will therefore continue to manufacture and sell arc welders and a complete line of batteries, including train lighting batteries. The Safety Car Heating & Lighting Company will be in position to furnish USL type car lighting devices, repairs and replacements.

Charles R. Long, Jr. buys interests of Harry Vissering

Charles R. Long, Jr., president of the Charles R. Long, Jr., Company, manufacturers of railway and industrial paints, Louisville, Ky., vice-president of Harry Vissering & Company, manufacturers of railway supplies and equipment, and vice-president of the Okadee Company, manufacturers of locomotive specialties, Chicago, and also vice-president of the Viloco Machine Company, manufacturing machinists and engineers, Benton Harbor, Mich., has purchased the entire interest of Harry Vissering in the above companies and Mr. Vissering has retired from all of these companies. Mr. Long was born in Louisville, Ky., and after graduating from high school in 1888 entered business as secretary and treasurer of the Stratler Bros. Tobacco Company, Louisville, Ky., which position he held from 1890 to 1896. In the latter year he organized the Charles R. Long, Jr., Company to manufacture railway paints. In 1909 he also became one of the organizers of Harry Vissering & Company. In 1913 he was one of the founders of the Okadee Company and later became one of the incorporators of the Viloco Machine Company. In the reorganization of the Viloco Machine Company, Mr. Long, vice-president, has been elected president, with headquarters at Louisville, Ky. In the reorganization of the Okadee Company, S. W. Russell, formerly secretary and treasurer of the Charles R. Long, Jr., Company, with headquarters at Louisville, Ky., has been appointed vice-president; J. S. Lemley, formerly mechanical expert, has been promoted to vice-president, with headquarters in the newly opened office in the Railway Exchange building, St. Louis, Mo., and W. H. Heckman, formerly mechanical engineer, has been promoted to vice-president. In the reorganization of Harry Vissering & Company, G. S. Turner, formerly vice-president, has been promoted to president. A. G. Hollingshead, president of the Okadee Company, and S. W. Russell have been appointed vice-presidents and W. H. Heckman, mechanical engineer, and J. S. Lemley, mechanical expert, have been promoted to vice-presidents. In the reorganization of the Charles R. Long, Jr., Company, A. G. Hollingshead, president of the Okadee Company, will be vice-president, and S. W. Russell, secretary and treasurer, has been promoted to vice-president.

Charles R. Long, Jr.

Personal Mention

General

JAMES KING, superintendent of shops of the Pacific Fruit Express at Colton, Cal., has been transferred to Los Angeles, Cal., succeeding L. E. Martmill.

C. L. BUCKINGHAM has been appointed engineer of tests of the Missouri-Kansas-Texas, with headquarters at Parsons, Kansas, succeeding N. J. Boughton, who has been transferred.

W. F. FLYNN, superintendent of motive power of the Michigan Central, has been transferred in a similar capacity to the New York Central, Lines East, with headquarters at New York.

J. ARCHIE JONES has been appointed general air brake supervisor of the Delaware & Hudson, succeeding H. A. Flynn, resigned to enter the service of the New York Air Brake Company.

H. W. FAUS, special engineer on the staff of the chief engineer of motive power and rolling stock of the New York Central Railroad, has been appointed engineer of materials and equipment tests, with headquarters at New York.

C. A. GARBER, master mechanic of the Illinois Central, with headquarters at Memphis, Tenn., has been appointed mechanical superintendent of the Missouri Pacific, with headquarters at St. Louis, Mo., succeeding W. C. Smith.

F. G. GRIMSHAW, general superintendent of motive power of the Southwestern region of the Pennsylvania, with headquarters at St. Louis, Mo., has been promoted to works manager at Altoona, Pa., succeeding P. F. Smith, Jr., who has been granted a leave of absence from active duty owing to ill health. Mr. Grimshaw was born on November 26, 1878, at Paterson, N. J. He attended Cornell University, and entered railway service on January 9, 1902, as a special apprentice in the Pennsylvania's shops at Altoona, Pa. From March to May, 1905, he was motive power inspector at Altoona. He then became a yard clerk on the Pittsburgh division and in May, 1906, was promoted to assistant yardmaster. From August of the same year to June, 1907, he was assistant master mechanic of the Monongahela division. He then became master mechanic of the West Jersey & Seashore and served in that capacity until September, 1912, when he was appointed assistant engineer of motive power of the Western Pennsylvania division. In November, 1914, he became assistant engineer of electrical equipment of the Philadelphia Terminal division. He was appointed superintendent of motive power of the New Jersey division in July, 1917, and in May, 1918, was appointed assistant to the general manager at Philadelphia. In March, 1920, he became superintendent of the Eastern division and served in that capacity for a year, when he was appointed superintendent of motive power of the Eastern Ohio division at Pittsburgh, Pa. In June, 1924, he became general superintendent of motive power of the Southwestern region.

F. G. Grimshaw

C. W. BUFFINGTON has been appointed district boiler inspector of the Eastern General division of the Chesapeake & Ohio, with jurisdiction over all points east of Huntington, W. Va., including the Huntington shops. Mr. Buffington's headquarters are at Clifton Forge, Va.

J. F. JENNINGS has been appointed superintendent of motive power of the Michigan Central, succeeding W. H. Flynn.

F. P. Neesley, division master mechanic of the Michigan Central at Jackson, Mich., has been appointed assistant superintendent of motive power, succeeding J. F. Jennings.

MERLE R. REED, master mechanic of the Pennsylvania at Logansport, Ind., has been appointed assistant general superintendent of motive power of the Northwestern region with headquarters at Chicago. Mr. Reed was born on June 26, 1883, at Newton, Ill. He attended Rose Polytechnic Institute from which he was graduated in June, 1905. Previous to this time he had served during the summer of 1904 as a laborer in the Terre Haute shops of the Pittsburgh, Cincinnati, Chicago & St. Louis, a subsidiary of the Pennsylvania. After his graduation he returned to the Terre Haute shops as a signal repairman. A few months later he resigned to become a special apprentice on the Union Pacific at Omaha, Neb. He returned to the Panhandle in September of the following year as a draftsman in the Terre Haute shops. In June, 1907, he was promoted to assistant foreman and in February, 1909, became chief draftsman. In April, 1917, he was transferred to the Northwest System of the Pennsylvania, Lines West, as a general car inspector, and was promoted to superintendent of car repairs on the Pennsylvania, Lines West, in September, 1918. He was appointed master mechanic of the Eastern division in August, 1919, and when the administration of the Pennsylvania was reorganized in March, 1920, he was transferred to the Logansport division as master mechanic.

M. R. Reed

Master Mechanics and Road Foremen

W. B. PORTER, assistant engineer of motive power of the Eastern region of the Pennsylvania, has been appointed master mechanic at Logansport, Ind.

W. F. LAUER, general foreman of the shops of the Illinois Central at Memphis, Tenn., has been promoted to master mechanic, with the same headquarters. Mr. Lauer was born on December 31, 1877, at Galion, Ohio. He attended the public and high schools at that place and on December 1, 1893, entered the employ of the Erie as a machinist apprentice at Galion. In December, 1897, he became a machinist on the Big Four at Bellfontaine, Ohio; in May, 1898, a machinist on the Lake Shore at Collinswood, Ohio; in January, 1899, tool foreman of the Erie at Galion; in January, 1904, machine shop foreman at Cleveland, Ohio; in January, 1908, general foreman of the Chicago & Erie branch of the Erie at Huntington, Ind., and in February, 1912, general foreman of the Illinois Central at Memphis.

W. F. Lauer

E. H. CARLSON has been appointed acting master mechanic of the Montana division of the Northern Pacific, with headquarters at Livingston, Mont., succeeding R. P. Blake, who has been temporarily assigned to other duties.

C. L. Gibson has been appointed master mechanic of the Stockton division of the Southern Pacific, with headquarters at Tracy, Cal., succeeding H. H. Carrick.

George H. Littlemore, formerly an engineman on the Idaho division of the Northern Pacific, has been appointed road foreman of engines of the Montana division.

C. W. Adams, superintendent of shops of the Michigan Central at Jackson, has been appointed division master mechanic at Jackson, Mich., succeeding F. P. Neesley.

Shop and Enginehouse

G. W. Dunning has been promoted to general foreman of the Southern, with headquarters at Columbia, S. C.

N. L. Vaughn, roundhouse foreman of the Missouri Pacific at Lexa, Ark., has been transferred to Little Rock, Ark.

George M. Gage has been promoted to enginehouse foreman of the Buffalo, Rochester & Pittsburgh, at East Salamanca, N. Y.

L. N. McCarl, night foreman of the Honey Pot enginehouse of the Pennsylvania, has been promoted to day enginehouse foreman.

J. A. Lasch has been appointed roundhouse foreman of the Missouri Pacific, with headquarters at St. Louis, Mo., succeeding J. B. Crahan.

Frank Fouse, whose appointment as shop superintendent of the Lehigh Valley at Packerton, Pa., was announced in the March issue of the *Railway Mechanical Engineer*, was born at Martinsburg, Pa. He attended the Juniata College and in 1896 entered the employ of the Pennsylvania railroad. Mr. Fouse has since been in constant railway service with several leading railroads. His experience included seven years abroad, during which time he became master car builder of the London shops of the Grand Trunk railway. Prior to his entering the employ of the Lehigh Valley, he had been transferred as master car builder to the shops of the Grand Trunk at Montreal.

Frank Fouse

Theo. Roberson, foreman of the Waldo avenue enginehouse of the Pennsylvania, has been transferred as enginehouse foreman to Meadows, N. J.

P. A. Schubert, gang foreman of the Northumberland enginehouse of the Pennsylvania, has been transferred to Wilkes-Barre, Pa., succeeding T. J. Parks.

T. J. Parks, gang foreman of the Pennsylvania at Wilkes-Barre, Pa., has been appointed night foreman of the Honey Pot enginehouse, succeeding L. N. McCarl.

G. W. McElrea, assistant foreman of the Waldo avenue enginehouse of the Pennsylvania, has been promoted to enginehouse foreman, succeeding Theo. Roberson.

J. B. Crahan, roundhouse foreman of the Missouri Pacific at St. Louis, Mo., has been appointed general foreman locomotive shops, with the same headquarters.

G. G. Davis, superintendent of shops of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Beech Grove, Ind., has retired from active service.

C. J. Balfour, gang foreman of the enginehouse of the Pennsylvania, at Meadows, N. J., has been promoted to assistant enginehouse foreman, succeeding W. H. Oyer.

W. H. Oyer, assistant enginehouse foreman of the Pennsylvania at Meadows, N. J., has been promoted to assistant foreman of the Waldo avenue enginehouse, succeeding G. W. McElrea.

H. H. Carrick, master mechanic on the Southern Pacific, with headquarters at Tracy, Cal., has been promoted to superintendent of shops at Los Angeles, Cal., succeeding W. A. Rogers, deceased.

H. D. Carpenter, motive power inspector of the Panhandle division of the Pennsylvania System, has been appointed enginehouse foreman of the Ohio River & Western, with headquarters at Zanesville, Ohio.

W. R. Benson, superintendent of shops of the Michigan Central at St. Thomas, Ont., has been appointed superintendent of shops at Jackson, Mich., succeeding C. W. Adams. Mr. Benson was born in 1889 at St. Thomas, and was educated in the public and high schools of that city. In 1906 he entered the employ of the Michigan Central as a machinist apprentice, serving in this capacity for four years. He then worked in several manufacturing plants at Detroit, Mich., and for the Canadian Pacific at Toronto, Havelock, MacTier and London, Ont. Re-entering the employ of the Michigan Central at St. Thomas in July, 1913, he served consecutively as piecework inspector, general piecework inspector, erecting shop foreman, general roundhouse foreman, assistant general foreman, general foreman and superintendent of shops.

Purchasing and Stores

W. F. Sanford has been appointed district storekeeper of the Chicago & North Western with headquarters at Green Bay, Wis., succeeding W. F. Redman, promoted.

E. H. Lehman, general storekeeper of the Ohio Central lines of the New York Central, has been appointed assistant general storekeeper, with headquarters at Columbus, Ohio.

J. C. MacDonald has been appointed district storekeeper of the Southern district of the Chicago, Milwaukee & St. Paul, with headquarters at Dubuque, Iowa, succeeding G. T. Richards.

J. P. Murphy, general storekeeper of the New York Central, lines west, with headquarters at Collinwood, Ohio, has been given jurisdiction also over the Ohio Central lines, with the same headquarters.

E. J. Leonard, division storekeeper of the Chicago & North Western at Clinton, Iowa, has been transferred to the Iowa division, with headquarters at Boone, Iowa, succeeding F. H. Fick, promoted.

G. T. Richards, district storekeeper of the Southern district of the Chicago, Milwaukee & St. Paul, has been transferred to the Northern district, with headquarters at Minneapolis, succeeding J. T. Kelly.

W. B. Hall, general storekeeper of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been promoted to general purchasing agent, with the same headquarters, a newly created position.

J. T. Kelly, district storekeeper of the Northern district of the Chicago, Milwaukee & St. Paul, with headquarters at Minneapolis, Minn., has been appointed chief stockman, with headquarters at Milwaukee, Wis., succeeding H. L. Brillinger, deceased.

Obituary

William A. Rogers, superintendent of the general shops of the Southern Pacific at Los Angeles, Cal., died on March 18. Mr. Rogers was born on December 25, 1874, at Brantford, Canada, and in 1887 entered the employ of the Grand Trunk, now the Canadian National, as a machinist apprentice. Upon completion of his apprenticeship, he traveled extensively, visiting various parts of the United States, Canada and Mexico. About 1893 he joined the construction forces of the New Orleans & North Eastern railroad. The following year he became master mechanic, handling much of the material used for the extension of the line across Louisana and Mississippi. About 1895 he was air brake and compressor mechanic of the Southern Pacific at Wadsworth, Nev.; about 1897 or 1898, machine foreman of the Oregon Short Line at Pocatello, Idaho, and in 1898 employed by the Prescott & Eastern railroad at Prescott, Ariz. In 1905 he entered the employ of the Los Angeles & Salt Lake, now the Union Pacific, serving consecutively as machinist; general foreman at Los Angeles, Cal., and master mechanic at Las Vegas, N. M. In September, 1914, he became general foreman of the Los Angeles shops of the Southern Pacific; and in October, 1917, superintendent of shops.